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Degree: Master of Nursing

Year this Degree Granted: 2000

University of Alberta

Motor Vehicle Collision And Fall Injuries

In A Rural And Urban Alberta Health Region

by

Jennifer R. Currie ©

A thesis submitted to the Faculty of Nursing

in partial fulfillment of the requirements for the degree of

Master of Nursing

Faculty of Nursing

Edmonton, Alberta

Spring, 2000

University of Alberta

Faculty of Graduate Studies and Research

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled Motor Vehicle Collision and Fall Injuries In A Rural and Urban Alberta Health Region submitted by Jennifer R. Currie in partial fulfillment of the requirements for the degree of Master of Nursing.

April 10, 2000

This manuscript is dedicated to my family who provided support and encouragement over many years of education, in particular to Len for his gentle confidence in me and steadfast support for my work, to Darin for sharing his study space, and to Eloise for her practical insight.

Abstract

Injury data from hospital morbidity files in Alberta's East Central Health Region (ECH) were used in this epidemiological description of injuries to urban and rural residents due to motor vehicle collisions and falls. The study was designed to examine the differences between urban and rural areas in terms of morbidity from selected causes of injury, to describe patterns of injury specific to rural and urban areas, and to contribute to the development and implementation of evidence-based interventions for injury control in those settings. Closer examination of the external causes of injuries from falls and motor vehicle collisions according to the International Classification of Diseases, Injuries, and Causes of Death, 9th Revision, (1995) Clinical Modification E-codes was completed and rates of occurrence were calculated for groups by rural, urban, female, male, and age groups in East Central Health Region. The findings, coupled with current research, suggest that East Central Health Region consider the adoption of a comprehensive, intersectoral, multidisciplinary approach to the development of policies and programs targeted to controlling injuries from falls among the elderly and in urban settings and injuries from motor vehicle collisions among young drivers and passengers, among males, and in rural areas.

Acknowledgements

I would like to express my deep appreciation to the chair of my thesis committee, Dr. Lynn Skillen, for the support, guidance, and overwhelming patience shared with me during all phases of this study. I also wish to thank the other members of my committee, Dr. Deanna Williamson and Dr. Duncan Saunders for their insight and commitment to the completion of the thesis. A special word of thanks to Dr. Phyllis Giovannetti for her kind encouragement.

East Central Health management and staff provided inspiration, assistance, and ongoing support throughout the research project. I would like to particularly recognize the corporate support for the project, access to the data files, and the interest of the community health staff in my research. To my managers, colleagues, and friends, I am sincerely grateful.

I also wish to acknowledge the invaluable contribution to the project by Alberta Health. Their assistance in furthering my understanding of the populations and postal codes was integral to the completion of the study.

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Chapter 1

Introduction

The study of injuries, injury prevention, and injury control is not the sole purview of a single discipline or profession. In fact, the multidisciplinary nature of injury investigation is one of its most noteworthy characteristics. Scholars representing health sciences, social science, engineering, transportation, marketing, political science, and international development have made significant contributions to the field of injury investigation. Published literature reveals strong evidence of the magnitude and impact of injuries around the world. The impact is particularly evident in industrialized nations where the decrease in morbidity and mortality brought about by the control of common communicable diseases has permitted the control of intentional and unintentional injuries to surface as a significant challenge (World Health Organization, 1995). To meet this challenge, demographic, economic, social, environmental, and cultural factors which influence the rate, prevalence, and consequences of injuries have been studied world wide. Generally, experts agree that a sound knowledge of the factors affecting the occurrence and consequences of injuries is essential to support plans for interventions intended to prevent and control injuries and their sequelae (Canadian Institute of Child Health, 1994; Chapdelaine & Rochette, 1990; Desmeules, Huang, & Mao, 1993; Gordon & Huang, 1995; Injury Prevention Centre, 1997.)

Despite the burgeoning level of interest about injury, health reform and the economic realities of preventable morbidity have only recently elevated injury control

and the prevention of long term disability from injury to a higher profile than previously known among health care planners. As a result, health departments across Canada have begun to hire injury prevention coordinators concerned with elements of primary prevention, and injury control specialists concerned with the entire spectrum of injury minimization (Injury Research Group, 1997). Specialists in injury prevention and control, epidemiologists, and researchers with expertise in program planning advise that it is prudent to have a solid statistical foundation in the incidence and prevalence of local injuries before embarking on strategic planning for preventative strategies (Choi, 1998; Injury Awareness and Prevention Centre & Harborview Injury Prevention Research Centre, 1992; Mallonee, 1997). Numerous differences in the causes of injuries in communities may be found. Interventions designed to address issues in one area may be irrelevant for another. To further the objective of an understanding of local conditions and to ensure solid underpinnings for the examination of issues related to morbidity caused by injury, it is clearly relevant to examine the appropriate data elements to support expanded planning for injury prevention and control from a regional perspective.

Purpose

Recently, regional health authorities in the province of Alberta have been encouraged to "take facts, data, and evidence into account" in their strategic and operational planning (Alberta Health, 1995, p.5). Within the seventeen health regions in Alberta, available evidence points to motor vehicle collisions and injuries related to falls as important external causes of morbidity and mortality. In particular, in the East Central Health Region, concern has been expressed by the health authority and by community

residents about the impact of injuries on health resources and on the personal lives of the residents (East Central Regional Health Authority, 1997).

If gains in the control of injuries and their consequences are to be achieved, then operational priorities of health authorities must be driven by indicators of locally relevant conditions with an understanding of the contribution of those conditions to morbidity and mortality. Injury-related interventions must be based on existing evidence and should be amenable to evaluation and tracking over time. However, decision-makers in health departments and regional health authorities are just beginning to have access to population-based injury research and strategies. Furthermore, a paucity of published research is available which compares injuries sustained in rural areas to those which occur in urban settings (East Central Regional Health Authority, 1997; Human Services Consulting Group, 1996). In fact, much of the published data analysis on injury either neglects the unique characteristics of rural populations or combines results from large and sometimes remote geographic areas to represent rural populations in general. With urban and rural indices undifferentiated, one aspect of planning for a geographically diverse area may remain problematic.

This study was designed to examine the differences between urban and rural areas in terms of morbidity from selected causes of injury, to describe patterns of injury specific to rural and urban areas, and to provide support for the development and implementation of evidence-based interventions in injury control in those settings. Until now, policy and program development in rural health authorities has largely been dependent upon provincially generated research, little of which has been further analyzed

by health region. Few attempts have been made to contribute to an understanding of the differences in the occurrence of injuries in large towns and smaller communities within individual regional health authorities.

Alberta's East Central Regional Health Authority (ECH) is aware that injuries are a problem for its residents. The organization is interested in addressing the problem and according to epidemiologists, phase one of planning interventions for health problems is analysis of data specific to the area of interest (Mallonee, 1997; Valanis, 1992). To that end, this research focused on an examination of the available injury data from hospital morbidity files in East Central Health Region. The findings provide a description of urban and rural injuries due to motor vehicle collisions and falls with more specificity for East Central Health than previously available.

Definitions

Injury. The general public often believes that accidents are freaks of nature and are somewhat unavoidable (Edwards, 1995; Garbarino, 1988; Sage Research Group, 1996). Conversely, practitioners who study the circumstances of injuries conceptualize most injuries as preventable occurrences. To prevent confusion, it is standard practice among injury analysis professionals to avoid the word "accidents" where possible and to use the word "injury" instead. Broadly, injury may be considered the combination of unintended or intended physical damage to an individual caused by the exposure to, or the transfer of, thermal, mechanical, electrical, or chemical energy. Physical damage may also result from the lack of heat or oxygen (Garbarino, 1988; National Committee for Injury Prevention and Control, 1989).

Alternatively, injury can be understood more categorically when used in an analytic context for understanding the nature and magnitude of the issue. Garbarino (1988) presents two clear categories to consider injury terms more specifically for close epidemiological scrutiny. In his taxonomy, Garbarino defines intentional injury as the damage that is purposefully caused by an individual to his or her body or to that of another person. Suicide and child abuse are examples of intentional injuries. Unintentional injuries, commonly called accidents, refer to the physical damage to an individual that is not purposefully caused, is unintended, or is inadvertent. This category could include motor vehicle collisions, falls, or poisonings (National Committee for Injury Prevention and Control, 1989).

Injury prevention and injury control. In addition to conceptual differences between the terms "accident" and "injury", approaches to dealing with injuries also differ. Andersson and Menckel (1995) clearly define the difference between injury prevention and injury control in their extensive conceptual analysis of activities related to intentional and unintentional injury. Injury prevention is the minimization of the actual cause of the injury by risk elimination or modification. Injury control includes and builds on injury prevention by reducing the consequences of injury; for example, prompt transfer to medical help or first aid may mitigate the effects of injury. According to Andersson and Menckel, injury prevention eliminates or modifies risk; injury control encompasses the entire spectrum of activities intended to reduce both risk and consequences of injury.

Rural and urban. Definitions for rural and urban are as varied as the studies

designed to address geographic risk factors. These studies will be further examined in the literature review. For the purpose of this research, rural and urban are defined according to population statistics from Statistics Canada and Alberta Health and Wellness. Communities with populations less than 2,500 are considered rural and communities with populations greater than 2,500 are considered urban.

ICD-9 CM E-codes. The study of injury prevention and control has been hampered by the absence of a readily accessible minimum data set specifically designed for injury surveillance. One alternative to an injury-specific database is the series of internationally accepted data collection codes initiated through the work of the World Health Organization several years ago for tracking hospital admissions and discharges. The codes provide for categories and subcategories of conditions under the International Classification of Diseases, Injuries, and Causes of Death, 9th Revision, (1975) commonly referred to as ICD-9 codes. Adjustments to the ICD-9 codes were made in 1977 for more detailed statistics and were called Clinical Modifications (CM). The ICD-9 CM codes are applied and collated by medical records staff from patient charts upon discharge from hospitals world-wide (Linwood & Willis, 1995; World Health Organization, 1995). To illustrate, the ICD-9 CM External cause codes (E-codes), identified as 800-999.9 in the ninth revision, delineate incidents of morbidity from injurious circumstances such as motor vehicle traffic accidents (E810.1-E819.9). Despite the fact that the codes were not actually designed for injury data analysis, the ICD-9 CM codes still have the potential to support an analysis of injury related hospitalizations based upon a compilation of standardized and accepted data.

Theoretical Framework

Theoretical concepts from a variety of scholars and practitioners were used to guide the design and purpose of this research project. Eclectic in nature, injury control is best supported from both health planning and health practice perspectives. With that in mind, the following section outlines the linkages among epidemiology, injury models, the McGill model of nursing, and health promotion. Finally, the linked concepts are presented as the basis for this study.

Haddon's model. The work of those who study injury is rooted in the principles of epidemiology. By considering the distribution of health and the factors contributing to deviations from health, practitioners are able to identify the circumstances, analyse data, and work to prevent or control the condition of interest, in this case injuries, through appropriately timed and evaluated public health interventions (Valanis, 1992). One of the most commonly cited theorists in published injury prevention literature is William Haddon. Particularly interested in motor vehicle collisions and injury, he is best known for his work in moving the epidemiological concepts of host, agent, and environment beyond the study of disease to include injury (Haddon, 1980). Haddon's matrix tool adds the *temporal* components of pre-event, event, and post-event to the analysis of specific injury situations for the purpose of designing multi-system interventions (Andersson & Menckel, 1995; Grossman & Rivara, 1992; Haddon, 1980; Winter, 1988). Moreover, Haddon considers the environment from both a physical and a socioeconomic perspective. Haddon takes the concept of agent, most easily understood as an infectious element, beyond the idea of a disease-causing germ to the less tangible level of energy.

As such, it is the movement of energy to individuals during a collision that has the potential to cause injuries (Andersson & Menckel, 1995; Haddon, 1980).

Although Haddon specifically identifies socioeconomic environmental influences in his model, other scholars have taken the concept further to postulate the potential that psychosocial factors may have in influencing injury. For example, in moving away from motor vehicle collisions toward injuries which resulted from falls, Edwards (1995) refers to the fact that the perception by the elderly that falls are inevitable for older adults can negatively influence their willingness to participate in activities designed to prevent falls.

<u>Andersson and Menckels' model.</u> Practitioners have expanded their understanding of injury analysis and have furthered Haddon's work by creating interdisciplinary models to guide injury control in the field (Chesham, Rutter, & Quine, 1993; Lehto, 1991; Linwood & Willis, 1995; Lourens, 1989). In 1995, Andersson and Menckel published a review of currently available literature about frameworks related to injuries and created the synthesized model that is used to support this research. In their analysis, disciplines such as mental health, occupational health, consumer safety, medicine, and public health are represented among the eleven injury-related theoretical frameworks that are reviewed. Three frameworks attributed to William Haddon are among them. Andersson and Menckel describe four essential elements among the basic concepts that apply to the study of injuries: (1) time related factors, (2) separation of interventions into levels, (3) direction of the prevention process, and (4) triad of host, agent, and environment. By organizing the features of each of the models according to

the four essential elements and relating each of the elements to the others, a synthesized version of the models is postulated.

Unfortunately Andersson and Menckel do not specifically delineate some concepts identified as key to individual practice by other researchers. For example, locus of control, dependency, and social support are considered important elements in occupational health (Baker, Israel, & Schurman, 1996; Matthias, May, & Guidotti, 1989; Skillen, 1993; Vojtecky, 1988). Behavioural scientists and engineers are concerned with the elements of individual behaviour, motivation, and decision-making (Chesham, Rutter, & Quine, 1993; Lehto, 1991; Lourens, 1989; Weinstein, 1988).

Andersson and Menckel's model contains additional descriptors of the essential elements. (1) The time related factors are outlined according to prepathogenic and pathogenic periods. (2) The levels of potential investigation and intervention are individual, community or organization, and society. (3) The direction of development and implementation of strategies may be "grass roots", for example community development, or "expertly driven" as in technology development. (4) The host, agent, and environment triad can be extrapolated into man-machine-environment if necessary depending upon the application circumstances (Andersson & Menckel, 1995). Given that the origins of the conceptual frameworks in injury analysis are multidisciplinary, Andersson and Meckel's manifestation of the essential elements of the models in common language bodes well for future inquiry and provides support to the multisectoral direction beginning to emerge for planners in injury control, despite the absence of psycho-social factors.

Injury and the McGill model of nursing. An overarching conceptual model used to organize complex concepts into more easily understood relationships is significant for nursing because a model affords a means with which to integrate complex concepts into community-based practise. As in Andersson and Menckel's "levels" of intervention, nurses' work may be within either a community or an organizational context. The "direction" of injury interventions involving nurses may include both a community development and an "expert" focus. The grounding in epidemiology, familiar to nurses as a traditional concept of medicine and health, provides the common element and the link for community-based, facility-based, or administrative nursing with injury control.

Moving on to incorporate injury control into nursing and health care can be accomplished through an explanation of a model of nursing that is based on health promotion practice. The McGill model of nursing was created with an understanding that many health problems are "linked to life styles and established health habits learned within a family context" (Gottlieb & Rowat, 1987, p. 52). Informed by the basic tenet of Lalonde (1974) which states that the health of a nation is its most valuable resource, the underlying assumptions of the model are highly supportive of a health promotion approach to problem solving. Hancock expands Epp's model to suggest several health promotion strategies. Those strategies most relevant to nursing include building health promoting public policy, reducing inequity, creating supportive environments, strengthening community action, supporting research, and establishing new structures (Epp, 1986; Hancock, 1994).

According to the McGill model, individuals as persons within families function

within a system that is interrelated with other systems in an environmental context. Changes to parts of the system influence the other dimensions in an interactive pattern. Person and environment are in constant association and it is through that association that all learning occurs (Gottlieb & Rowat, 1987). Congruent with the system of relationships among host, agent, and environment from epidemiology and man, machine, and environment from occupational health and engineering, the McGill model allows for systems thinking within an environment supportive of health promotion.

The McGill model advocates for partnerships on differing planes in which nurses and those engaged in the relationship contribute to health through varying degrees of expertise (Allen, 1981; Gottlieb & Rowat, 1987). In other words, the McGill model and injury control advocates both encourage intersectoral partnerships and coalition development for health related concerns. It is through cooperation on several levels, individual, organization, community, and society, that increases in understanding the nature of injuries will progress. For this study, building and sharing the essential results of data analysis may contribute to advances in the work of injury practitioners in creating sustainable initiatives appropriately targeted to the injury issues among susceptible populations.

Summary of the research project. This descriptive epidemiological study, limited to the population of East Central Health Authority in Alberta, was designed to contribute to strategic planning about the two leading causes of injury-related hospitalization in that region. The study examined the geographical influences of rural or urban residence on the hospitalization of individuals injured from falls and from motor vehicle collisions.

Additionally, the hospitalization data were categorized according to ICD-9 CM E-codes and were organized in groups according to place of residence, gender, and age in an effort to determine the principal external causes of injuries from falling and from motor vehicle collisions among the population of East Central Health residents.

The chapters that follow outline the progression of the research project. Chapter 2 provides a broad overview of injury data and precipitating factors related to injuries from falls and injuries from motor vehicle collisions. Chapter 3 outlines the methods and procedures that were used to organize the data and conduct the data analysis. The results of the data analysis are presented in chapter 4. A discussion of the findings and their implications for further strategic planning are in chapter 5 followed by conclusions and recommendations in the final chapter.

Chapter 2

Literature Review

A review of the literature provides background and support for the analysis of hospitalization data about injuries experienced by residents of one large health region in central Alberta: East Central Health Region. Data collection, trends, issues, and factors associated with injury-related death and hospitalization and, more specifically, those hospitalizations resulting from motor vehicle collisions and from falling, are summarized. Following a brief introduction to data collection and international injury statistics, the literature review addresses the national perspective then focuses on a more limited presentation of injury and hospitalization issues from a provincial, Alberta perspective.

The literature review for this research was prepared from a variety of electronic and hard print sources. First, the key words accident prevention, wounds and injuries, protective devices, primary prevention, traffic accidents, accidental falls, automobile driving, and motor vehicles were used to search the Medline database for English language reviews and general articles over the last ten years. Next, the CINAHL database was searched for peer reviewed, English language research over the same period with the key words safety, child safety, equipment safety, occupational safety, passenger safety, patient safety, accidents, accidental falls, home accidents, occupational accidents, traffic accidents, car safety devices, protective devices, head protective devices, environment, and architecture. The ERIC database was searched for English

language reports and the key words accident prevention, motor vehicles, falls, bicycling, safety education, safety equipment, school safety, traffic accidents, traffic safety, injury, and prevention were used. In addition, the key words accident prevention, wounds and injuries, protective devices, primary prevention, traffic accidents, accidental falls, automobile driving, and motor vehicles were used in the Healthstar database in order to find English language review articles from 1986 to the present. Finally, unpublished Master's theses and Doctoral dissertations from the Faculty of Nursing, University of Alberta, current relevant journals, Health Canada publications, Alberta Health reports, unpublished agency reports, and conference proceedings were reviewed manually for material relevant to this study. Expert guidance in the search process was obtained by consultation with key practitioners in the field of injury from Alberta's Injury Prevention Centre.

Challenges Associated With Data Collection

Internationally, nationally, and provincially, analyses and comparisons of data collected in relation to injuries are hampered by the differences in the comprehensiveness of reporting systems, linkages among data collection sources, accuracy of data tabulation, definition of terms, exclusivity or overlapping of data categories, and delineation of population groups (Berger & Mohan, 1996; Sheps, 1989; Trinca et al., 1988). Comparison of injury issues and strategies is further compromised by the wide variation in the information collected and reported. The most pressing issues for injury control vary from one country to the next as do the level of technological sophistication, vehicular motorization, and governmental regulation.

Canadian injury data sources. The problems with international comparisons of injury epidemiology and strategic development are imitated nationally on a smaller scale (Stanwick, 1991). Many independent sources of information are utilized in the compilation of statistical estimates to describe details of injuries in Canada (Injury Prevention Centre, 1993). The data sources are as varied as the injury issues themselves possibly because "injuries are everyone's concern but no one's mandate" (Pless, 1989, p. 428). Police and fire departments, Ministries of Transportation, Agriculture, and Labour, and departments of vital statistics are but a sampling of the organizations with a vested interest in tracking injury issues. Each establishes a different level of importance for the collection of details about the circumstances of injury. Most use different software and computerization to tabulate their results. Many combine collection of injury information with the collection of other administrative or client related information. In Canada, there is a longstanding request from practitioners, researchers, and academics for the creation of a separate nation-wide data collection system with the singular purpose of supporting and monitoring the injury problem (Injury Prevention Centre, 1991; Pless, 1989; Safety Coordinating Advisory Council, 1994; Sherman, 1990; Stanwick, 1991). Although recommendations for data linkages among the various departments that collect injury information have been put forward, the implications for jurisdiction and privacy within such a system are daunting.

The Canadian Accident Injury Reporting and Evaluation system. Despite the absence of an all-encompassing national injury data collection system, particularly at the primary care level, there have been efforts to approximate a registry. One of the earliest

national injury data projects was The Canadian Accident Injury Reporting and Evaluation system of the Product Safety Branch of the Department of Consumer and Corporate Affairs (CAIRE). The system coordinated the collection of information about injuries related to product safety from five hospitals but the scope of the information and the generalizability of the results were limited (Linwood & Willis, 1995; Pless, 1989).

The Canadian Hospitals Injury Reporting and Prevention Program. The most recent attempt to create a national source of epidemiological injury information is the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) sponsored by Health Canada's Health Protection Branch through the Laboratory Centre for Disease Control and the Bureau of Reproductive and Child Health. Established in 1990, CHIRPP originally involved ten pediatric hospitals across the country. The initiative is modelled on the American and Australian experiences with national injury data collection systems. Data about the actual circumstances surrounding injury events are collected from people who present to the emergency departments of the chosen hospitals and their attending physician using written surveys completed by both the victim (or guardian), and the physician (Cullingham, 1997; Pless, 1989).

Limitations to the CHIRPP data collection system are evident. For instance, people who do not seek hospital emergency room service, the severely injured who bypass the emergency room, or those who die from their injuries at the scene are not included in the program. Moreover, the participating hospitals do not represent all of the facilities that might be accessed in the case of an injury. CHIRPP has attempted to become more representative by expanding its mandate to include six general hospitals

and to collect data for adults as well as children. Nevertheless, the majority of data collection still occurs in pediatric hospitals, located in large urban centres. In addition, some segments of the population such as aboriginal people, older youth, adults, seniors, and people who live in rural areas are under represented (Child Injury Division, 1995; Linwood & Willis, 1995).

Mindful of these limitations, CHIRPP proponents point out that there is an advantageous and relatively short lag time between data collection and the ability of the researchers to produce usable reports. According to CHIRPP, collected data are entered into their system within four months of collection and analysis and summaries can be available within weeks (Child Injury Division, 1995). Efforts are made to regularly post the data summaries on an Internet web site to ease access to the information by those in the field. By contrast, morbidity and mortality data used by the World Health Organization and Alberta Health typically requires a year and often longer before the information is compiled, analysed, and made available in published form.

Despite the restrictions of morbidity and mortality data, they have been the mainstay of injury control analysts and practitioners for many years. Hospitalization and death statistics provide at least a partial picture of the extent of the injury problem across the country and are used as a basis for the examination of many injury issues. Augmented by alternate sources of information such as national surveys, regionally collected statistics, or local research projects, morbidity and mortality data can become a rich source for acquiring vitally important clues to relevant injury policy and program strategies.

International Injury Statistics

The World Health Organization (WHO) has been monitoring population health status for many years. As a recognized authority on the state of international progress toward the improvement of factors associated with health, WHO continues to report about issues of disease and injury. In 1995 the World Health Organization reported that injuries are a persistent and increasing problem world wide. More specifically, developing countries report four times more deaths from injuries as the developed nations. Using WHO's ICD-9 data reports, community studies, and ad hoc surveys compiled from 189 member states in 1993, the World Health Organization estimates that injuries killed eight percent of the global total in that year or the equivalent of four million people. While there are limitations to the data due to under reporting, particularly from poorer nations, the mortality estimates still place accidental death eighth in rank order.

WHO estimates that there are approximately 10 million recorded road accidents per year and in 1993, road accidents accounted for injuries to 9.9 million people. There were untold numbers of concomitant unreported or untreated injuries. Although the World Health Organization Report covers data on road accidents, injuries related to falling are not analyzed separately and are included among other categories. Occupational injuries, including those related to falls and some transportation related injuries, involved 120 million cases, resulting in the disability of 1 million people (World Health Organization, 1995). The figures, staggering as they are, are recognized as underestimates of the actual numbers.

Injuries in Canada and Alberta

Two major research reports, one national and the other provincial, offer a description of injury and other health indicators in Canada and Alberta and are useful in determining the causative factors of particular types of injuries.

The Health of Canada's Children: a CHIC profile. Nationally, the Canadian Institute of Child Health (CICH) offers one of the most comprehensive profiles of the well-being of Canadian children and youth and provides a statistical summary of numerous indicators of child health. In its publication The Health of Canada's Children: a CICH Profile (1994) the Institute uses supplemented morbidity and mortality data, compiled information from the 1991 national census data, vital statistics information on birth and mortality, hospitalization statistics on morbidity, and national and provincial surveys. Its data analysis relies heavily on Statistics Canada mortality-external causes, micro-data files for their injury related information. Extracting details from the CICH report about injuries to children exemplifies the magnitude of the injury problem in this country.

The Alberta Injury Data Report. Strongly supporting the results of the CICH profile, the Alberta Injury Data Report (1996) was produced by the Alberta Injury Prevention Centre, now known as the Alberta Centre for Injury Control and Research. The report provides a comprehensive view of injury in Alberta and in 17 regional health authority catchment areas. Based on information from Vital Statistics, Alberta Registries, the Alberta Health hospital morbidity and mortality database, and Alberta Health population and census data, the report describes injuries over a three year period

and includes important summaries of injury trends over a ten year period. The age groups in the CICH report are more finely divided than the age groups in the Alberta Injury Data Report and the age groupings differ. Therefore, information about the Alberta age groups will be presented in the older age category as defined in the CHIC report.

Injuries during childhood. The Canadian Institute of Child Health (1994) report shows that health problems in infancy are primarily related to low birth weight and congenital anomalies and that these are the predominant cause of premature death, particularly in the earliest weeks of life. After the first month of life, injuries were listed as the fourth leading cause of death for Canadian children and were primarily related to suffocation, motor vehicle collisions, and homicide. In addition, of the infants whose injuries required treatment in hospital, a fall was the primary cause for 18% of injuries.

After infancy, patterns of injury occurrence begin to appear among age groups. Information from CICH (1994) stated that injuries are the primary cause of death among preschool Canadian children age 1-4 years and accounted for 40% of all deaths in that age group. Preschool boys were found to have a rate of mortality 1.8 times higher than that for preschool girls. Of the injuries which resulted in death in the five year period 1986-1990, 38% of all injury deaths or 6/100,000 were motor vehicle related and were almost equally divided between pedestrians and passengers. Provincially, in Alberta in 1994, 42% of the injury-related deaths of preschool children were from motor vehicle collisions, the highest percentage in the three year period from 1992-1994. Among Alberta preschool children who required hospitalization as a result of injury in 1994,

32% were injured from falls and 7% from road incidents.

When reporting on the leading cause of death among children ages 5-9 , CICH states injuries accounted for 49% of all deaths in 1990. Cumulatively, in the 5 year period 1986-1990, motor vehicle accidents were implicated in 56% of fatalities caused by injuries in this age group or a rate of 6/100,00. Of those children killed in motor vehicle accidents, 43% were pedestrians, 32% were passengers and an additional 16% of the deaths were cyclists. Moreover, injuries ranked second only to respiratory diseases as the main causes of hospitalization in the 5-9 year old age group in 1990 and, once more, 42% of all admissions were the result of injury caused by a fall. A further 11% of the hospital admissions were due to motor vehicle collisions and 8% were cyclists.

In the same period, (1986-1990) CICH reports that over half of the deaths to Canadian children between the ages of 10 and 14 years were related to injury. Half of the fatalities in this age group were in road accidents, and of those fatalities, 39% were passengers in vehicles, 22% were pedestrians, and 20% were cyclists. Of those injuries which required hospitalization, 33% were due to falls and 13% were from motor vehicle collisions.

Examination of the mortality figures specific to Alberta in the age group 5-14 shows that they are similar to the national figures for the previous two age groups (Injury Prevention Centre, 1996). In this age group, 43% of injury deaths were caused by motor vehicle collisions. Although the percentage of injury hospitalization from road incidents in Alberta (13%) was similar to the Canadian percentages (reported above), those which resulted from injuries caused by a fall (36%) were higher.

At 73% of teenage deaths, injuries were the chief cause of deaths for Canadian teenagers in 1990. Motor vehicle collisions were implicated in 50% of the deaths of male teens and in 66% of the deaths of female teens. The figures represent a rate of 42/100,000 males and 16/100,000 females for an overall rate of 29/100,000. Among Albertans age 15-24 years, deaths related to injury (44%), occurred primarily from motor vehicle collisions. For Canadian males, injury, particularly from car accidents, was the primary reason for hospitalization. Data specific to Alberta in 1994 show that 22% of hospitalizations caused by injury in the 15-24 age bracket were due to road accidents, while 12% were due to falls (Canadian Institute of Child Health, 1994; Injury Prevention Centre, 1996).

Injuries among adults. Taken beyond childhood, examination of similar data calculated a few years later for causes of morbidity in Canadians shows a corresponding picture. Typifying the reporting differences used by disparate agencies, staff with Statistics Canada have prepared a useful data presentation for adults that complements and confirms that offered in the CICH children's profile but carries the discussion further through the life span.

Using 1993 vital statistics data on morbidity from each territorial and provincial registry compiled according to ICD-9 codes, Wilkins (1996) indicates that death rates for all causes and over all ages were higher in males than in females. Reiterating the conclusions in the CICH report on children and youth, deaths from external causes such as motor vehicle collisions and suicide are cited as the causative factor in the overall gender difference in death rates. That is, in 1993, among those age 20-44, almost 50% of

deaths among males and 33% among females were from injuries. Motor vehicle collisions killed adult men at a rate of 21/100,000. In women, the death rate from motor vehicle collisions, the leading cause of death, was 8/100,000. The Alberta Injury Prevention Centre report (1996) splits the age group examined by Wilkins into two groups: 25-34 years and 35-44 years. Even so, the percentages of injury deaths from suicide and motor vehicle collisions are consistent throughout: about 40% from suicide and about 20% from motor vehicle collisions.

Considering data as the population ages, non-external causes of death such as circulatory diseases and cancer logically begin to predominate when reported by percentage of overall deaths. However, when death *rates* are considered, external causes and injuries remain at levels similar to those in younger age groups. In 1996, Wilkins calculated that men and women aged 45-64 had only 6-9% of deaths which were attributed to external causes but the death rate from motor vehicle collisions for males was still 15/100,000 and for females 7/100,000 (Wilkins, 1996). In similar age groups in Alberta, 45-54 and 55-64, over the years 1992-1994, 31-45% of all deaths caused by injury were from suicide and 20-24% were from motor vehicle collisions. The main cause of hospitalization was due to injury resulting from a fall or a motor vehicle collision (Injury Prevention Centre, 1996).

Injuries among seniors. Although injuries accounted for only 2-3% of the overall deaths among people over age 65, they exemplify the struggle in interpretation of injury percentages and injury rates. Deaths of men from falls occurred at a rate of 56/100,00 and, in women, 59/100,000 (Wilkins, 1996). But, according to Riley (1992), accidental

falls accounted for 56% of accidental deaths and 65% of injury-related morbidity in people over age 65. Rates of morbidity and mortality due to injuries were found to increase with age. Deaths among women which were related to motor vehicle collisions occurred at a rate of 12/100,000, a rate approximated by the female group at least 50 years younger (Wilkins, 1996).

In Alberta, motor vehicle collisions caused 20-28% of the injury mortality for older adults over three years. In the 75-84 year old age category, motor vehicle collisions and fractures ranked first and second in 1992, 1993, and 1994 among the leading causes of injury mortality. In an interesting study by Evans (1993), data from the Fatal Accident Reporting System in the Unites States were used in a longitudinal analysis of driver fatality rates for identified cohorts over a fifteen year period. The rates were noted to decline for cohorts of drivers until age 70 but then the fatality rates almost double by age 80.

Unfortunately, injuries from traffic accidents, despite the rates previously described, are not the most pressing concern among the elderly. Given the projected increases in the size of the aging population over the next several years and the proportion of those living beyond the age of 80 years, morbidity and mortality from injuries related to falls will become important issues (Desmeules, Huang, & Mao, 1993; Gordon & Huang, 1995). After age 85, fractures consistently caused almost half of the deaths related to injury. Injuries from falls let to hospitalization in 60-70% of the cases for all people over the age of 65 from 1992-1994 inclusive (Injury Prevention Centre, 1996).

Stokes and Lindsay (1996) examined changes in morbidity and mortality over the period 1984-1993 among the elderly in Canada. Using linear regression of the logarithm of the age-standardized mortality rates, they worked with ICD-9 codes for the major causes of death and hospitalization for each province and territory. Desmeules, Huang, and Mao (1993) used similar procedures in their projections to the year 2000 of deaths and hospitalizations of seniors. Stokes and Lindsay's analysis was limited to the top 15 ranked causes of morbidity and mortality for each gender. In some cases, data were missing from Yukon Territory. Unfortunately, their results do not indicate values for mortality as a result of a fall in males because they were not as prevalent as non-external causes in terms of frequency and therefore, were not within the top flight. In the female population, they found an age-standardized mortality rate related to falls of 51.42/100,000 over a ten year period.

Factors Influencing Injuries

Identifiable factors influence the rate of death and hospitalization which can be attributed to injuries in each stage of growth and development over the life span. Much of the published literature challenges the concept of accident proneness and supports the impact of parent behaviour in childhood injury events (Garbarino, 1988; Grossman & Rivara, 1992; Hu, Wesson, Parkin, & Rootman, 1996). Grossman and Rivara (1992) provide a thorough examination of injuries in children and the elements salient to injury events in that age group. They recognize injury as the most important cause of death and disability after the first year of life, and their review centres on host factors and their interaction with the strategies of education/persuasion, legislation/regulation, and

modification of the environment/technology.

Income and social class. James Garbarino, in his work on developmental and mental health issues relevant to childhood injury control, concurs with Grossman and Rivara (1992) when he states that "...environmental hazards are disproportionately relevant as a function of income and social class. Indeed, poor children are at higher risk for many negative effects, including injury" (Garbarino, 1988, p.31). Many studies cite poverty as an important environmental influence particularly related to traffic injuries (Garbarino, 1988; Grossman & Rivara, 1992; Linwood & Willis, 1995; Reutter, 1995). For example, living conditions among poorer families may preclude the purchase of safety equipment (such as child passenger restraints), or influence the choice of safe housing location (such as next to high speed roadways).

Awareness and complacency. Hu et al. (1996) found that more than half of the 1516 parents surveyed in urban and semi-rural communities in Ontario knew that injuries are a leading cause of death and disability to children and were correct in estimating that motor vehicle collisions are a significant agent. However, several studies show that it is the home environment, usually perceived as a safe haven for young ones, that is the most frequent site of injuries to small children and that these injuries show a tendency to be correlated with developmental stages (Bienefeld, Pickett, & Carr, 1996; Garbarino, 1988; Hu, Wesson, & Kenny, 1993). Unfortunately, awareness does not lead to appropriate action or even to an understanding that childhood injuries may be avoidable (Hu et al., 1996; Marrongiello & Dayler, 1996). For instance, results from surveys nationally or limited to regional areas have shown that children are incorrectly restrained in child

safety systems in 50%- 80% of cases observed (East Central Regional Health Authority, 1996; Safe Kids Canada, 1996; Transport Canada, 1990; Yacoub, 1993). Clearly, there is an educative role for primary health care practitioners who interact with parents and children at significant developmental points in the early years (Bass et al., 1992). Among older children, injuries occurring on playgrounds, while playing sports, and while cycling hold particular promise for harm reduction. Many of those injuries occur as the result of falls (Bienefeld, Pickett, & Carr, 1996; Brown & Farley, 1989; DeLalla, 1996; Gibson & Klassen, 1996; Hu, Wesson, Parkin, Chipman, & Spence, 1993; Lenaway, Ambler, & Beaudoin, 1992; Rowe, Rowe, & Bota, 1995; Schwartz & Brison, 1996).

Age and risk-taking. In the teen years, injuries from motor vehicle collisions reach an alarming rate. Although factors related to injuries among the teenage group begin to mimic those of adults, sports and athletics persist as major contributors (Gibson & Klassen, 1996; Glor, 1989; Lenaway, Ambler, & Beaudoin, 1992). Several studies support consideration of risk-taking behaviour, as it pertains particularly to the use of motor vehicles, as a major factor in youth injury (Chesham, Rutter, & Quine, 1993; Grant, Lane, Janus, & Okovita, 1995; Weinstein, 1988). Chesham et al. used path analysis in their study of motorcyclists and reported that youth and inexperience are strong predictors of unsafe behaviour. They theorize that social and psychological variables are important mediators in risk taking. "Age and experience have their effects through beliefs and attitudes, so that the critical feature of youth...is not youth itself but the attitudes that typically go with it" (Chesham et al., 1993, p.427).

Entry into employment and forays into the use of alcohol are additional

influences in the incidence of accidents and injuries in young people. Nationally, data support estimates that up to 80% of teenagers between 15 and 19 years of age used alcohol to varying degrees in 1990 (Canadian Institute of Child Health, 1994). These figures can be supported by data from police sources which show that males from 18-21 years of age are most likely to be involved in an alcohol related collision (Alberta Transportation and Utilities, 1995). At the same time, occupational statistics indicate that more than half of all Canadian youth 15 years and older were employed in 1991 and that occupational injuries are a serious concern in this age group (Canadian Institute of Child Health, 1994; Glor, 1989). When youthful employment is added to the fact that up to 30% of the labour force drive vehicles as part of their occupation, inexperience and risk taking have the potential to be major factors in vehicle related injury among the young (Alberta Transportation and Utilities, 1995; East Central Regional Health Authority, 1997; Waxweiler, Harel, & O'Carroll, 1993).

Decisions by drivers and passengers. The Workers Compensation Board reports statistics about death and injury incurred by people during employment situations. Thirty-six percent of the occupationally related mortality to adults in 1996 was from motor vehicle collisions on public roads (Alberta Labour, 1997). Although factors outside the control of the driver are cited in the majority of collision incident investigations involving the public in general, additional trends appear which are related to driver error, alcohol use, late afternoon and night-time driving, rural or urban driving location, use or non-use of restraint devices, and absence or presence of air bags in the vehicle (Beirness, Simpson, Mayhew, & Wilson, 1994; Chapdelaine & Rochette, 1990;

Safety Coordinating Advisory Council of the Transportation Association of Canada and the Canadian Council of Motor Transport Administrators, 1994; Waters, Gibbons, Semenciw, & Mao, 1993; Zador & Ciccone, 1993).

Falls among the elderly. The factors that influence the occurrence of a fall in the elderly have been well researched and include sensori-motor deficits, failing health, declining mental status, environmental conditions, medication, poor footwear, and previous experience of a fall. Multiples of the factors make the situation even more precarious (Morse, 1997; Tinetti, Speechley, & Ginter, 1988). The typical sequelae of the incident of a fall in the frail elderly can be devastating, particularly for those people who had a poor baseline mental status before the incident (Marottoli, Berkman, Leo-Summers, & Cooney Jr, 1994). Few researchers have yet claimed to have the key to highly significant behavioural or environmental change which will move the older population in the community beyond basic awareness (Hahn, Van Beurden, Kempton, Sladden & Garner, 1996; Ploeg, Black, Hutchinson, Walter, Scott, & Chambers, 1994).

Rural and Urban Residence as a Factor in Injury

Criteria for rural or urban. To appreciate living in a rural setting as a risk factor first requires an understanding of the meaning of rural and urban among injury researchers. Little consistency can be found in the literature to support a single, common understanding of the terms rural and urban as applied to research and reports about injuries. Usually, population statistics are calculated to explain the meaning of the terms as risk factors. For example, Dunsire and Baldwin (1999) adopted the American convention to define rural and urban in their Australian study of drinking and driving

among late teens. The American researchers Room and Alvarez (as cited in Dunsire & Baldwin, 1999) defined rural as communities of less than 50,000 people and urban as communities of greater than 50,000 people.

Some researchers have attempted to create surrogates for concepts related to rural or urban indicators. Jones and Bentham (1995) found that population size had little to do with the timely transfer of injured patients because the populations studied in Great Britian were not geographically dispersed across large areas. Their findings may indicate that geographic distribution as well as population size may be important to consider simultaneously when possible.

Canadian researchers have worked with multi-faceted criteria in some cases: "Rural areas are defined by Statistics Canada as those enumeration areas that are not continually built-up, have a population of less than 1000 people, and a population density of less than 400 people per square kilometer" (Sahai et al., 1998, p. 321). The means to apply the concept of "continually built-up", however, is unclear.

Alberta Transportation and Utilities defined urban in an all-inclusive, sweeping definition: "...any area within the corporate boundaries of a city, town, village, or hamlet" (Alberta Transportation and Utilities, 1997, p. xi). All areas not included in the urban category were defined as rural. Villages and hamlets in Alberta have fewer than 1000 residents, may be situated in the midst of farming areas, and are not likely influenced by urban lifestyles. However, this broad definition of urban may be prompted by the need to investigate the actual location of collisions and not the residential status of those involved.

Two independent Alberta studies based on rural and urban differences used only population statistics to define the variables. The first study used four selected communities of defined population size as representative samples to generalize the findings across Alberta (Thomson & Russell, 1994). The second study used samples from the whole Alberta population and assigned them to four study groups according to residence in large urban centres, smaller cities of 10,000-100,000 residents, towns of 1,000 or more, and rural settings including farms, villages, and hamlets (Johnson, Ratner, & Bottorff, 1995). The second example most closely approximates the criteria selected for this study.

Social considerations. Comparatively, there are discrepancies in how rural and urban geographic factors are operationalized in research studies. Most definitions ignore the social factors that become part of the fabric of small town life for people in communities of greater than 400 and less than 10,000 or, as defined in some studies, 50,000. Joanne Ouellete developed an insightful commentary about rural and small town Alberta based on the work of Dr. Edward Van Dyke and Robert Redfield. She stated "... we immediately encounter difficulty if we attempt to define small and large communities in terms of numbers. One's perception will depend on whom they are being compared to. For instance, Edmonton would be defined as large for someone living in Peace River but small for someone in New York" (Ouellette, 1994, p.17). Although written to describe northern and isolated communities, many of the ideas may be applied to small town and rural life in central Alberta. Ouellette proposes that beyond population numbers, there may exist differences in the relationships and values held by differing

groups. Those living in small towns experience closer personal relationships in a less formal interaction. In some cases, these relationships may influence enforcement of regulations. Small town values lean to the conservative with a slower pace of life. This may contribute to the perception of "infringement on personal rights" when regulations are created to enhance safety. Technology may be less complex in smaller communities and may take longer to be incorporated into routines of lifestyle. People in smaller communities tend to rely less on formal structures but create solutions to some problems as a homogenous group, utilizing their own resources (Ouellette, 1994; Thompson & Russell, 1994). Some public health practitioners believe that significant progress could be made in influencing health in small communities if their common experiences could be harnessed to build strategies specific to their life circumstances (Bavington, 1994).

Influence of rural residence. At all age levels, living and working in rural areas presents a particular set of circumstances that influence the type, frequency, and severity of injuries. For instance, the risk of injuries from vehicle crashes is influenced by distance travelled, routine speed, type of vehicle, roadway features, access to alternate transportation, and access to prompt, expert emergency care (Safety Coordinating Council of Motor Transport Administrators, 1994). It follows that all of the influencing factors may vary according to geographic location and rural farming provides yet another example (To, Wacker, & Dosman, 1993).

Farming equipment is often cited in rural injuries and, since men more often operate farm machinery than women, serious injuries from the use of farm equipment are more common in males. (Gerberich, Tae-Yong, Gibson, Carr, Shutske, & Reiner, 1996;

Injury Prevention Centre, 1994). Further, in the United States, research on occupational injury mortality comparatively in urban and rural settings has shown alarming findings. Researchers found that if the urban occupational injury fatality rate had been applied in the rural setting in the study year, there would have been 54% fewer rural deaths. These differences were particularly strong in the west and mountain plains areas just south of Alberta (Marine & Derstine, 1996).

It was clear from the literature that few aspects of injury in a rural environment have received particular study and those which result from a fall have certainly not received attention. More particularly, studies have not focussed on describing the nature of the issue according to a rural/urban differentiation. Research studies specifically directed toward the incidence of injury caused by a fall and considered relevant to rural populations actually include large segments of city or town dwellers in a regional context and are not separated into different samples according to a smaller, more specific definition of rural and urban within the initial regional boundaries (Injury Prevention Centre, 1996).

Economic Burden

Desmeules et al. predict that hospital admissions related to a fall in the elderly will increase on average by more than 11% in the next several years. The economic burden of injuries currently being experienced by the health sector is already considerable. Moore, Mao, Zhang and Clark (1997) estimated that the societal cost of injuries in Canada was the third highest economic burden for any diagnostic area of morbidity at over 14 million dollars per year. Therefore projected increases in the

impact of injuries on the system will challenge the health sector to develop cost effective, efficient, and acceptable measures to control them. Retrospect will show how accurate the projections are when considered in light of the systemic changes in hospital admission policies under health restructuring.

In summary, it is evident that the current body of published research and expert commentary sustains the premise that injury is an important issue for many sectors of society including health. Motor vehicle collisions and falls in all age groups result in expensive morbidity and mortality both in personal terms and from economic perspectives. Questions remain about the similarities and differences between the incidence, external causes, and hospitalization of urban and rural residents and, consequently, the appropriateness of interventions that are developed to address injury events in those communities. If the theoretical underpinnings of injury prevention and control recommend that data analysis support planned interventions, then it is vital for data to pertain to the target group of interest. For one health region in Alberta, East Central, supportive research was needed to investigate the influence of geographic location, age, and gender on the incidence of hospitalization from injuries caused by motor vehicle collisions and falls. The following chapter provides an outline of the research methods that were designed to address some of those questions about injuries.

Chapter 3

Methods

A descriptive epidemiological design was selected for this pilot project conducted in one health region in the province of Alberta (Valanis, 1992). Chiefly concerned with the relationship between geographic location and the occurrence of injuries, the pilot examined the external causes of injuries from motor vehicle collisions and injuries from falling by rural and urban residence according to hospital separation and International Classification of Diseases, ninth revision, Clinical Modification External cause codes. To carry out the project, permission was obtained to conduct a secondary analysis of morbidity data files held by East Central Health for the total population of residents of the Region.

Research Questions

The similarities and differences in the character of injury in rural and urban East Central Alberta related to falls and motor vehicle collisions were examined using the following research questions:

1. What was the number and rate of hospitalization from falls and from motor vehicle collisions from April 1, 1993-March 31, 1998 among rural dwelling residents of East Central Health Region?

2. What was the number and rate of hospitalization from falls and from motor vehicle collisions among urban dwelling residents of East Central Health Region?

3. What was the number, proportion, and rate for different categories of external causes of injuries requiring hospitalization, by urban and rural residence, from falls and from motor vehicle collisions, among residents of East Central Health Region?

Pilot Project

The long range objective of the research, and the original intent of this project, was to examine a rural and urban split of the provincial morbidity data for injuries from falls and motor vehicle collisions across the entire province of Alberta. As the research project progressed, it became clear that to take on the volume of data required for the provincial project was beyond the scope of this study. It was decided that a smaller scale version of the research would be manageable and would provide an excellent template for the provincial study. Therefore, a pilot study was conducted in one of the seventeen Alberta Health Regions.

Population

East Central Health Region is one of seventeen regional health authorities (RHA) in the province of Alberta (see Appendix 1). Fifth largest of the RHAs, East Central has a population of approximately 103,000 people spread across thirty-eight thousand square kilometres with fifty-nine municipalities. Camrose, with a population of approximately 15,000 people, is the only *city* completely within the boundaries of the region. Lloydminster would appear to be within East Central Health on the map but the city is bisected by the provincial boundary between Alberta and Saskatchewan and its residents share health services with both provinces. Adjacent to East Central Health Region, but unique in its governance structure, Lloydminster has its own, small, independent Health

District. Stettler, Vermilion, and Wainwright are the largest *towns* in East Central with populations ranging from 3,500 to less than 6,000. The rest of the region's residents live in smaller towns, villages, hamlets, or on farms and acreages.

The number of residents over age sixty-five is much higher than the provincial average and the average income level is lower, perhaps as a result of retirement and fixed incomes. About 30% of the population are employed in farming, forestry, and oil or gas exploration. A further 20% participate in public service such as education, health, and government jobs. Ethnic origin of the region's residents is relatively homogenous and largely British and German but the level of education is lower than the provincial average (East Central Regional Health Authority, 1997)

<u>Data Collection</u>

Data collection to support this research project was not primarily collected by the researcher. Instead, information about injury-related hospitalizations was accessed by East Central Health Region from Alberta Health through the Alberta Hospital Morbidity Database, the system used to track hospital and auxiliary hospital in-patient discharges. The hospitalization data are collected by trained medical records clerks in facilities across the province. Medical records staff typically attend post secondary educational institutions at the community college level to learn the intricacies of the technical work that they perform. Detailed instruction including interpretation of ICD-9 codes, completion of the computer generated fields, and the standard methods of reviewing records for data collection are contained in the course curriculum. The importance of inter-rater reliability is included and students participate in a clinical

practicum prior to graduation.

Following patient discharge from hospital, medical records staff closely scrutinize each chart for information to complete computer generated fields. The fields include the underpinnings of this research (the ICD-9 CM E-codes) used by the medical records clerks to define the external cause of injury hospitalization of each person with a hospital chart. The computerized information is sent to Alberta Health as an administrative tool for management purposes.

The use of ICD-9 CM E-codes as the basis for injury research projects has been supported and practised previously (Ozonoff, Tan-Torres, & Barber, 1993; Pless, 1989; Raina & Torrance, 1996). According to consultants with Statistics Canada, data entry reliability among medical records clerks is considered to be consistently high except in the interpretation of locally generated fields (J. Bustros, personal communication, September 5, 1997). For the purpose of this research project, locally generated fields were not included in the data set for analysis.

Along with the advantages of using ICD-9 E-Coded data, come the disadvantages. Most limitations to research using coded data revolve around specificity and contextual factors not included in the data collection at source. For example, the morbidity data do not have codes for details such as how a fall occurred or whether the sidewalk was ice-covered or dry. In addition, socio-economic, psycho-social, and cultural factors are not available. From an analytical perspective, the morbidity data represent accumulated occurrences of injury; the data cannot be assumed to necessarily reflect the experience of unique individuals. Should an individual experience three separate injury-related

hospitalizations in a single year, the data reflect a count of three admission occurrences, they do not reflect one person admitted to hospital three times. Moreover, although the place of current residence is coded for each individual, it does not always follow that the injury actually happened in, or close to, that location. The data only indicate that a person who lives in a specific residence was injured somewhere in Alberta and was hospitalized as a result. Clearly, injury research based on morbidity data is but the foundation for a much broader picture requiring supporting qualitative and evaluative research to fully capture the scenario.

Although not originally intended for regional research studies, the requirements of the collection process for morbidity data allowed for large segments of the East Central Health region's population to be studied with non-intrusive means using a reliable data collection system. Vast population-based survey methods were not required, thereby removing the need for interviewer training and coordination. Furthermore, the expense of contract personnel to handle volumes of paper or to conduct telephone calls was avoided (Kiecolt & Nathan, 1987).

Data Files and Variables

The study was limited to an analysis of hospital separation data specifically related to motor vehicle collisions and falls for the population of residents of East Central Region for the period April 1, 1993 to March 31, 1998. It was recognized that the frequencies of interest to East Central Health for a single year, some of which had been previously cited in the Injury Prevention Centre's 1996 data report, would be too small to support the finer analysis according to residence, gender, and specific E-codes. Wanting

to create results that would contribute to preliminary program planning, the data for that five year period were summed to provide more substantial overall frequencies and the procedures were applied to the entire data set.

Alberta Health hospital morbidity file. The hospital morbidity data file for the residents of East Central Health was accessed with the consent of East Central Health management and through the cooperation of their Regional Data Coordinator (see Appendix B). Selected variables were drawn from the provincial data base containing information about all hospital discharges of patients from every hospital in the province. The selected variables were collapsed into a single, new data file for the purposes of this research project and were limited to East Central Health Region residents by either the postal code or the Regional Health Authority number assigned by Alberta Health (Table 1). Specifically, the variables were: admission date, discharge date, length of stay (in days), age, age code, sex, residence code, residence municipal code, resident postal code, Regional Health Authority number of residence, most responsible diagnosis, and fifteen variables related to additional diagnostic codes used at the discretion of the medical records technicians. It is in one of the fifteen variable fields that the ICD-9 CM E-codes for the selected injuries are located.

Table 1

Falls/Motor Vehicle Collisions Morbidity File: Variables (4457 records)

Abbreviation	Definition
admit_dt	date of admission
month	month of admission
disch_dt	date of discharge
los	length of stay
age code	day, month, or year
age unit	actual age
rsdt sex	patient sex
rsdt_mun	residence code of the patient
rsdt_md	municipal district of the patient
Mrdx	most responsible diagnosis
Dx 1 - Dx 15	**diagnosis:15 fields (E-coded injury variables)**
rsdt_pc	resident postal code
RHA res	recipient RHA from residence code
RHA pt	recipient RHA at March 31
All seps	count of the records

The following three tables include the definitions of the ICD-9 CM E-code variables from the East Central Health Hospital morbidity files contained in the fifteen fields for

diagnosis. Definitions provided with the tables are brief; more detailed explanations are provided as text in Chapter 4 .

Table 2

Falls

ICD-9 CM E-codes for Injury Morbidity Data

Code	Description
E8800	Escalator
E8809	Stairs or Steps
E8810	Fall from Ladder
E8811	Fall from Scaffolding
E882	Fall from or out of Building or other Structure
E8830	Accident from Diving or Jumping into Water
E8831	Accidental Fall into Well
E8832	Accidental Fall into Storm Drain or Manhole
E8839	Fall into Other Hole or Other Opening in Surface
E8840	Fall from Playground Equipment
E8841	Fall from Cliff
E8842	Fall from Chair or Bed
E8849	Other Fall from One Level to Another
E885	Fall on same Level from Slipping, Tripping, or Stumbling
E8860	Fall in Sports
E8869	Other and Unspecified--Fall on Level
E887	Fracture, cause not Stated
E888	Other and Unspecified Fall

Table 3

Motor Vehicle Collisions

ICD-9 CM E-codes for Injury Morbidity Data

Code	Description
E810	Motor Vehicle accident involving collision with train
E811	Motor vehicle accident involving re-entrant collision with another motor vehicle
E812	Other motor vehicle accident involving collision with motor vehicle
E813	Motor vehicle accident involving collision with other vehicle
E814	Motor vehicle accident involving collision with pedestrian
E815	Other motor vehicle traffic accident involving collision on the highway
E816	Motor vehicle accident due to loss of control, without collision on the highway
E817	Non-collision motor vehicle accident while boarding or alighting
E818	Other non-collision motor vehicle accident while in motion
E819	Motor vehicle accident of unspecified nature

All of the 3 digit ICD-9 CM E-codes for motor vehicle collisions have a fourth digit

appended to describe the individual injured. The definitions for those injured are outlined in Table 4.

Table 4

Motor Vehicle Collisions: Individual Injured

ICD-9 CM E-codes and Injury Morbidity Data Description

Code	Description
.0	Driver of motor vehicle
.1	Passenger of motor vehicle
.2	Motorcyclist
.3	Passenger on motorcycle
.4	Occupant of streetcar
.5	Rider of animal; occupant of animal-drawn vehicle
.6	Pedal cyclist
.7	Pedestrian
.8	Other specified person
.9	Unspecified person

East Central populations and postal codes file. East Central residents' postal codes and the population census numbers were obtained through the cooperation of Alberta Health with East Central Health. Working closely with a biostatistician, the Statistics Canada population figures according to census sub-divisions within the region and the Alberta Health registration information was collapsed to create a data file

specific to East Central Health. No individual identifiers were included in this file. The variables selected for the East Central Health region are described in Table 5.

Table 5

East Central Health Populations/Postal Code File: Variables (1747 records)

Abbreviation	Definition
ID	Chronological number
PC	Postal code
Fed EA	Federal enumeration area
Retired	A=active I=inactive postal codes
Municipality	Municipality of postal code
CSD	Census sub-division
RHA98	the RHA number for the postal code (in this case 7)
Pop 97-98	Population registered with Alberta Health by postal code
CSD Name	Name of community by census sub-division
CSD Type	County, municipal district, special area, town, village
U/R	Urban or rural designation
CSD Pop	Population of community according to census

Data Preparation and Reduction

Following consultation with staff from the Alberta Centre for Injury Control and Research, the ICD-9 CM E-codes that are indicative of hospitalizations from the injuries of interest were identified and selected from the provincial morbidity data base for residents of East Central Health. Some of the information fields for patients were

missing elements that had to be explained. For example, the East Central morbidity file included children less than one year of age. Along the field for age, infants were listed in arabic numbers according to their month of age. A different field included a code to indicate whether the arabic numbers referred to months, as for infants, or years. The 47 infants captured in the data file were reassigned to zero to permit their inclusion in the age related analysis without requiring a link to the age code variable.

It was important to include as many of the appropriate residents of East Central Region as possible. Therefore, in addition to the postal codes, the RHA number assigned to a file in the absence of the postal code was also accessed. Alberta Health uses the residence municipal code as a substitute for place of residence if the postal code is missing and uses that to determine the RHA. The postal code was selected as the means for much of the data analysis. Therefore, any cases that were missing postal codes but included a residence code were assigned a surrogate postal code based upon a rural or urban designation described below. This procedure involved 137 missing cases. Finally, a new field was generated, called rural/urban, to permit cases to be assigned to groups according to place of residence.

Rural/ Urban Criteria

Considering the population census numbers, the Alberta Health registered population, and the postal codes of those registered with Alberta Health, the following criteria were developed to split the hospital morbidity data file and were considered the best possible option in light of the information available. The population and postal codes file was used to match postal codes with the designation of rural or urban. Based

on a comparison of the population registered with Alberta Health and the population of the place of residence according to Statistics Canada, a decision was made to designate every postal code in the region with a label of rural or urban.

Rural. For the purpose of this study, a group of people was included in the designation of rural if the Statistics Canada census subdivision was named as County, Municipal District, or Special Area. The people that lived in these areas all had T0 prefixes in the Alberta postal code. Further, towns in this category had a census population of less than 2,500. For hamlets, villages, and small towns, the majority of the population mix actually lived outside of the census sub-division for the area as indicated by the surplus number of people registered with Alberta Health when compared to the actual census population.

Urban. The population was designated as urban if the municipality of residence had a postal code with the prefix T1, T2, T3...T9. These usually represented the larger centres in the region with populations greater than 3,500. Towns with census populations greater than 2,500 and more than 60% of the residents registered with Alberta Health lived in postal code areas included within the census boundaries for the town were also included. One large town factored into the urban category when the latter criterion was applied. It had postal codes with T0 prefixes but a population greater than 2,500.

Retired postal codes. Once the decision had been made to designate a postal code as rural or urban, each of 1,747 postal codes were individually tagged with that label in a separate field. Some postal codes were noted as "retired" but they still had

people registered with Alberta Health using the postal code as part of their address. The retired postal codes were assigned according to the designation of the original town from which they were derived.

Data Analysis

The first of the analysis procedures involved linking the data files through Access software on the postal code field according to the ICD-9 CM E-codes for injuries from motor vehicle collisions or injuries from falls. The format of the morbidity files dictated application of each query to the fifteen diagnostic fields separately. In order to be able to visualize the results coherently, spreadsheets were developed by entering the sums of the cases of injuries from each diagnostic field into sub-groups according to place of residence (three spreadsheets), gender (two spreadsheets), age (ten spreadsheets) , and combinations of those variables. Each analysis run was created independently and the spreadsheets were not linked in any way. Therefore, it was possible to check the accuracy of the data entry on the spreadsheets by manually creating sums of all of the frequencies according to the groups and comparing them to each other and to the overall frequencies for the region. When errors were found, it was possible to return to the original data run of each diagnostic field according to the group of interest and correct the problem. Following rigorous combing of the data and the spreadsheets, the only unexplained elements on the spreadsheets were five cases that were contained on the all-inclusive, the rural/urban, the female/male, and the length of stay spreadsheets but were missing from the age-specific spreadsheets. The only plausible explanation for this discrepancy is that the cases were included in the data base with the date of birth field

coded as unknown. After the spreadsheets were corrected and verified, the cases were totalled and, finally, summarized into categorical groups according to ICD-9 CM E-codes for comparison purposes.

Rendering the data into a meaningful form involved calculations of the frequencies, proportions, rates, and hospital days rates. The frequencies were visible from the initial spreadsheets created from the data runs. Detailed analyses were limited to cells of twenty or greater from the regional perspective and to ten or greater for the defined groups. This decision was based upon the potential use of the results to identify common elements for further investigation. In that case, detailed calculations for occurrences of very small numbers would not likely be useful. However, length of stay for those injury-related hospitalizations with low frequencies was examined to ensure that important relationships between low frequencies and high length of hospital stay, and consequent high health care costs, were not missed. Proportions were determined by two methods. First, the overall proportion of hospitalization for each group (female, male, rural resident, urban resident) according to injuries from falls or from motor vehicle collisions was calculated (hospitalization for group/hospitalization of all ECH residents from same injury cause). Then, proportions were calculated within groups according to ICD-9 CM E-code category (hospitalization from E-888 among females/ hospitalization from all falls among females).

Rates of injury-related hospitalization were calculated according to the (1993-1998) five-year hospitalization frequencies, the population figures used from Alberta Health Registries in 1998, and a constant based on 1000 population (frequency of

hospitalization/population of group x 1,000).

Using the 1998 population figures to calculate the rates was based on the ability to break the frequencies of hospitalization into groups according to the data files that contained those population numbers as their base. According to the most recent East Central Health business plan, Alberta Registries, and independent calculations, East Central Health has a fairly stable population that has changed over five years by less than 1%. Therefore, there is a negligible effect to using the 1998 population figures rather than the usual midpoint population of the five years of interest.

The decision to use 1,000 as the constant for rates calculation was not arbitrary. Most of the rates cited in recent reports use a constant of 100,000 and frequencies based on one year of data collection. Comparison of the rates in this research, based on frequencies over a five-year period, with rates determined using frequencies collected over a single year would result in misconceptions. It was decided to discourage such comparisons by using a constant not commonly seen in studies of injury.

Total length of stay in hospital by days was available in the data base so average length of stay in days and hospital days rates were calculated, again, by group and according to ICD-9 CM E-code categories. Because of the differences in population numbers, the hospital days rates provided a useful means to compare resource utilization and duration of acuity for each injury type by population group. The hospital days rates were calculated using the total number of days of hospitalization/population by group x 1000.

Finally, tables were created to bring together the frequencies, proportions, rates,

length of stay, hospital days rates, and population according to groups. For a detailed explanation of the procedures and steps taken to analyze the data, see Appendix D.

Ethical Considerations

The first step in obtaining permission to utilize the existing data was through Alberta Health. The request to Alberta Health for access to the morbidity data held by the Injury Prevention Centre was intended to support a provincial examination of the injury data. Letters of support were forwarded to Alberta Health from the Injury Prevention Centre and from the East Central Regional Health Authority (now East Central Health). Unfortunately, the negotiated agreement between the Injury Prevention Centre and Alberta Health does not include secondary data analysis or release provisions. Alternatively, Jane Curry, of the Information Services Unit of Alberta Health, recommended that a consensual agreement with the regional health authority could be utilized. Correspondence occurred between East Central Health and Alberta Health in which a data coordinator was identified and communication channels were opened for consultation with the Information Unit. On March 12, 1997, a request for the injury morbidity data, according to detailed specifications supplied by the Injury Prevention Centre, was forwarded by the data coordinator and by June 1997, the data were held within the regional health authority. Following several unsuccessful attempts to apply the analysis procedures to the provincial data set, the original project was revised to focus on East Central residents only. A new data agreement was developed and signed on July 16, 1999 (see Appendix B). Great care has been taken by Alberta Health and East Central Health to ensure that appropriate access to the data is maintained and

subjects are protected. Ethical approval to proceed with the research project was granted by the Health Research Ethics Board of the University of Alberta in April, 1998 and on April 23, 1999.

The Chief Executive Officer and the Chairman of the Board of East Central Health are well informed of the details of the current project, protection of the subjects of the research, and appropriate storage of the data. Liaison has been maintained through the data coordinator employed by the RHA. A final report of salient findings and recommendations is expected by East Central Health to support planning for injury control. The final report of the research project requires approval from the Minister of Health prior to publication and the RHA has committed to facilitating that process (see Appendix C).

The research design of this project exemplified a non-intrusive approach. Although not involved in obtaining information directly from study subjects, the primary investigator still carries a responsibility to ensure the security and confidentiality of the data. As such, the data are stored on disc in a locked cabinet accessible by key held by the primary investigator. The computerized information is retrievable only through use of a secured password. The original research proposal indicated that published reports of the data analysis would be limited to cells of four or more cases. However, it is more practical to consider the five year period being examined and to limit reporting to cells of twenty or greater for regional analyses and, within groups, to ten or greater. Individual identifiers are not included in the data set and, therefore, the names of those injured are not accessible.

The chapter that follows outlines the results of this secondary data analysis for East Central Health. Hospitalizations for injuries from motor vehicle collisions and falls are presented according to frequency, age, gender, and rural or urban residence. Further, the categories of injuries according to the definitions within the ICD-9 CM E-codes are used to divide the results into comparable tables containing details about rates, length of hospital stay in days, and hospital days rates.

Chapter 4

Results

Frequencies of hospitalization for injuries resulting from motor vehicle collisions and injuries from falling provide information that Regional Health Authorities can use for planning and policy development. The research methods for this project were enhanced by access to all injury-related hospitalization data for the total population of Alberta's East Central Health region residents for five full years. Such a volume of data provides a breadth to the analysis that would not be possible using information from a single year.

For the purpose of this study, the population of interest, ECH residents, was sub-divided into rural residents, urban residents, female residents, and male residents according to the circumstances surrounding their hospitalization due to injuries. The outcome of the data analysis is organized in a series of tables that were created by collapsing specific categories of the International Classification of Diseases Clinical Modification (ninth revision) hospitalization data coded according to external cause of the injury (ICD-9CM E-code). The first two digits of the codes represent either hospitalization from injury due to falls (**88**) or due to motor vehicle collisions (**81**). The third and fourth digit of each code indicates, for injury from falls, the circumstances surrounding the incident, for example fall from building (88**2**) or fall from playground equipment (88**4**), and for motor vehicle crashes, both the circumstances and an attribute of the person injured, for example driver (813**0**), or person on bicycle (813**6**).

The method of data analysis was to run frequencies of all of the ICD-9 E-coded data for hospitalization over the years 1993-1998 according to the E-codes defined for injuries from motor vehicle collisions and falls. Including all of the fifteen diagnostic fields permitted production of the results according to each population group and all of the injury codes. For clarity of presentation and further discussion, results have been reorganized so that all of the population groups defined in the analysis will be visible according to the same injury category under scrutiny. The tables outlining findings about injuries resulting from falls are presented first, followed by the findings from analyses of injuries from motor vehicle crashes. Included in the tables are summaries of the data according to frequency of hospitalizations (Freq.), the proportion (Prop.), the rate of hospitalization for that category of injury per one thousand residents (Rate per 1000), the average length of hospitalization in number of days (LOS), the hospital days rate per one thousand residents (Hospital Days Rate per 1000), the total number of days spent in hospital from 1993-1998 by ECH residents (Total Length of Stay), and the population numbers for each group (Popln.). Calculations of the injury rates per one thousand people and the hospital days rate per one thousand are included in both sections. Basing the rates on a denominator according to the actual population figures for East Central Health controls for population density differences and provides a common foundation for comparison of results.

Falls

Injury hospitalization resulting from falls. In total, ICD-9 CM E-codes include twenty-six external cause codes that pertain directly to hospitalization from injuries

related to falling. The official definitions of the ICD-9 E-codes are all-inclusive and are very specific regarding the kind of injuries that health records technicians in hospitals are to exclude from each category. An explanation of the relevant E-code accompanies each table.

According to the ICD-9 instructions for health records technicians, the overall Accidental Falls (E880-E888) category includes hospitalizations resulting from *all* falls *except* those in or from a burning building, into a fire, into water with submersion or drowning, occurring while operating machinery, on an edged or pointed object, or from a transport vehicle. All of the excluded conditions are captured by E-codes in other categories and are not included in the accidental falls data codes.

<u>All categories of hospitalization from falls</u>. Results of the analysis of hospitalization from injuries due to all falls over a five year period by residents of Alberta's East Central Health Region are presented in Table 6.

Table 6

Hospitalizations Due to Injury From All Falls by Residence and Gender

ICD-9 E880.0-E888 inclusive

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	3382	1.0	32.52	10.67	347.05	36092	103996
All Rural	1999	.59	36.36	9.38	341.1	18753	54978
All Urban	1383	.41	28.21	12.54	353.73	17339	49018
All Female	1916	.57	36.71	11.65	427.61	22318	52192
All Male	1466	.43	28.3	9.4	265.89	13774	51804

The figures presented in the second column of Table 6 represent the proportion of hospitalizations for *all* injuries from falling that occurred in either the urban/rural group or in the female/male group. The frequency, rate of hospitalization, and the total length of hospital stay reported in Table 6 are higher in the rural population than in the urban population. This order is not reflected in the average length of hospital stay or in the hospital days rate. All reported parameters are higher for female residents of East Central than for males. The rate of overall fall injuries and the hospital days rate for

women reflect a notable difference over those for males.

The remainder of the tables in this section contain data according to twelve of the defined categories of falls. For six of the twenty-six E-code fields, the analysis resulted in frequency cells that were too small to break down for comparison purposes. The excluded categories are E8800 (injury from falling on escalator), E8830 (injury from diving or jumping into water), E883 (injury from falling into a well), E8832 (injury from falling into storm drain or manhole), E8839 (injury from falling into a not previously identified hole or other opening in a surface), and E8841 (injury from falling from a cliff). Eight E-code categories contained no data at all for the region or the category was further sub-divided to better describe the circumstances and the parent category was empty; for example the category E881: fall on or from ladders or scaffolding was empty but the sub-categories of E8810 (fall from ladder) and E 8811(fall from scaffolding) have data of interest. Specific to the external cause being described, the figures presented in the second column of the tables in this section refer to the proportion of hospitalizations that occurred *within* each group. Finally, Table 19 and Table 20 present a compilation of data and calculations according to all of the age groups by rate of hospitalization and by hospital days rate. References to the information contained in these two tables are threaded throughout the descriptions of each of the specific categories and their adjacent tables.

Hospitalizations from falls on stairs or steps. Table 7 contains information about injuries incurred from falling on stairs or steps that are not escalators, moving sidewalks, or street curbs (E8809). Of the injuries being presented for discussion, these falls rank

consistently third or fourth except for the average length of stay which drops to fifth or sixth. For rural residents and for females, hospitalization is at a higher rate/1000 and the hospital days rate is notably higher. Injury caused by falling from stairs or steps displays differences by age groups. The very young, 0-4 years (20.93/1000) and the elderly, 75-84 years (11.40/1000) and 85 and older (12.5/1000) are hospitalized more often from these injuries than are young people and adults whose rates range from 1.02/1000 to 5.93/1000.

Table 7

Hospitalizations Due to Injury From Falls

ICD-9 E880.9 (stairs/steps)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	284	0.08	2.73	6.79	18.52	1927	103996
All Rural	179	0.09	3.26	6.59	21.28	1170	54978
All Urban	105	0.08	2.14	7.21	15.44	757	49018
All Female	163	0.09	3.12	7.32	22.86	1193	52192
All Male	121	0.08	2.34	6.07	14.17	734	51804

Hospitalizations due to falls from height. Tables 8, 9, and 10 represent injury categories that rank among the least frequently reported reasons for hospitalization and contain some of the shortest hospital days rates. Table 8 contains information about injuries caused by falling from ladders (E8810); Table 9 injuries caused by falling from scaffolding (E8811); and Table 10 injuries caused by falling from or out of buildings or other structures such as a bridge, flagpole, window, or through a roof. These categories do not include injuries caused by the collapse of a building, or a fall or jump from a burning building. Although women are represented under the falls from ladders category, the three tables are dominated by males. In all cases, the numbers for rural residents exceed those for urban residents and tend to most often be experienced by

people between the ages of 25-64. The empty cells in two of the three tables represent data elements less than 10 and were not considered to be appropriate for this analysis. Ethical considerations dictated data disclosure of cells with 4 or more cases, however, for practical purposes, it was determined that frequency of hospitalization over five years of less than ten incidents in a single category would likely preclude any logical follow-up program or policy development and the cells were excluded.

Table 8

Hospitalizations Due to Injury From Falls

ICD-9 E881.0 (ladder)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	114	0.03	1.1	4.96	5.44	566	103996
All Rural	71	0.04	1.29	5.13	6.62	364	54978
All Urban	43	0.03	0.88	4.7	4.12	202	49018
All Female	24	0.01	0.46	5.38	2.47	129	52192
All Male	90	0.06	1.74	4.86	8.44	437	51804

Table 9

Hospitalizations Due to Injury From Falls

ICD-9 E881.1 (scaffolding)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	21	.006	0.2	3.52	0.71	74	103996
All Rural	15	.008	0.27	3.53	0.96	53	54978
All Urban	⟨10	-	-	-	-	-	49018
All Female	⟨10	-	-	-	-	-	52192
All Male	18	0.01	0.35	3.61	1.25	65	51804

Table 10

Hospitalizations Due to Injury From Falls

ICD-9 E882 (building,window)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	54	0.02	0.52	3.39	1.76	183	103996
All Rural	36	0.02	0.65	3.94	2.58	142	54978
All Urban	18	0.01	0.37	2.28	0.84	41	49018
All Female	⟨10	-	-	-	-	-	52192
All Male	50	0.03	0.97	3.32	3.2	166	51804

Hospitalizations due to falls from playground equipment. Table 11 contains information about injury hospitalizations resulting from falling from playground

equipment (E8840). The results are just below the midpoint for all groups in terms of rank order of hospitalizations in all the categories. Of the age-related associations, these injuries occur only to those aged 0-4 (rate:13.69/1000; hospital days rate:177.13) and aged 5-14 (rate:4.21; hospital days rate: 8.37). It is the most prevalent falling-related injury for those aged 5-14.

Table 11

Hospitalizations Due to Injury From Falls

ICD-9 E884.0 (playground equipment)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	89	0.03	0.86	1.84	1.58	164	103996
All Rural	58	0.03	1.05	2.02	2.13	117	54978
All Urban	31	0.02	0.63	1.52	0.96	47	49018
All Female	34	0.02	0.65	2.35	1.53	80	52192
All Male	55	0.04	1.06	1.53	1.62	84	51804

Falls from chair or bed. Table 12 contains information about hospitalization from falling out of a chair or a bed (E8842). There is a higher rate of falling from chair or bed among urban residents and among women in the region. Of particular note is that the hospital days rate for urban residents is twice that for rural residents. Individuals aged 0-4 years (11.27/1000), 75-84 years (10.31/1000), and 85 years and older (22.8/1000) are, once again, the most affected by this kind of injury.

Table 12

Hospitalizations Due to Injury From Falls

ICD-9 E884.2 (chair or bed)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	161	0.05	1.55	14.85	22.99	2391	103996
All Rural	81	0.04	1.47	10.51	15.48	851	54978
All Urban	80	0.06	1.63	19.2	31.42	1540	49018
All Female	100	0.05	1.92	11.43	21.9	1143	52192
All Male	61	0.04	1.18	20.46	24.09	1248	51804

Hospitalizations due to falls from one level to another. Table 13 contains information about hospitalization resulting from falling from one level to another including (but not limited to) falls from an embankment, haystack, stationary vehicle, or tree. Rural residents and male injury rates are twice that of urban residents and females. The hospital days rate for rural residents is also double that of urban residents. This finding is not reflected in the hospital days rate for males and females. Children 0-4 years old rank as those most affected by this kind of injury and falling from a chair or bed has the highest hospitalization rate for that age group at 21.74/1000 (hospital days rate: 44.28).

Table 13

Hospitalizations Due to Injury From Falls

ICD-9 E884.9 (one level to another eg. tree, haystack)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	226	0.07	2.17	5.84	12.7	1321	103996
All Rural	157	0.08	2.86	5.89	16.81	924	54978
All Urban	69	0.05	1.41	5.75	8.1	397	49018
All Female	73	0.04	1.38	9.56	13.37	698	52192
All Male	153	0.1	2.95	4.07	12.02	623	51804

Hospitalizations due to falls on one level. Table 14 contains information about hospitalizations resulting from slipping, tripping, or stumbling on the same level. Rural residents are hospitalized at a higher rate than urban residents. Females have a hospital days rate twice that of males. Injuries from this external cause are manifested at all age levels but most prominently for those adults 65 years and older. Trips, slips, and stumbles occur at a rate second only to the category for injuries not well defined or explained on the records.

Table 14

Hospitalizations Due to Injury From Falls

ICD-9 E885 (trip, slip, stumble)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	1061	0.314	10.2	11.06	112.88	11739	103996
All Rural	614	0.31	11.17	9.73	108.66	5974	54978
All Urban	447	0.32	9.12	12.9	117.6	5765	49018
All Female	694	0.36	13.3	11.34	150.83	7872	52192
All Male	367	0.25	7.08	10.54	74.65	3867	51804

Hospitalizations due to injuries from falls during sports. Table 15 contains information about hospitalization from injuries due to falling on the same level due to collision or push from another person while participating in sporting activities. This category includes tackles but excludes being kicked, stepped on, or struck by objects during sports. Those injuries are captured in other E-code categories. Sports injuries result in hospitalization more often for males (data for females had to be removed due to small numbers) and for people in rural areas. Data could only be analyzed for age groups 5-14 and for 15-24 due to the very low or non-existent number of injuries in the cells for the other age groups.

Table 15

Hospitalizations Due to Injury From Falls

ICD-9 E886.0 (sports)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	51	0.02	0.49	1.52	0.75	78	103996
All Rural	35	0.02	0.64	1.57	1	55	54978
All Urban	16	0.01	0.33	1.44	0.47	23	49018
All Female	⟨10	-	-	-	-	-	52192
All Male	41	0.03	0.79	1.54	1.22	63	51804

Hospitalizations due to fractures. Table 16 represents hospitalization not necessarily after suffering a fall but from fractures that have no actual cause specified on the patient chart. Many unspecified fractures are the result of falls although they do occur for many other reasons such as motor vehicle collisions, during sporting activities, and from crush injuries while working. The hospital days rates, total length of stay, and average length of hospital stay are much higher among women than for men from injuries due to fractures.

Table 16

Hospitalizations Due to Injury From Fractures

ICD-9 E887 (fractures cause not specified)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	72	0.02	0.69	0.24	7.83	814	103996
All Rural	32	0.02	0.58	11.53	6.71	369	54978
All Urban	40	0.03	0.82	11.13	9.1	445	49018
All Female	42	0.02	0.8	13.95	11.23	586	52192
All Male	30	0.02	0.58	7.6	4.4	228	51804

Hospitalizations due to injuries from all other falls. Table 17 contains information about hospitalization from injuries that are reported to be caused by falling after bumping against an object or by causes not stated in other codes in the ICD-9 guidelines. Unfortunately, the category may be important from an administrative and funding perspective related to hospital services, but it is of limited value from an epidemiological and program planning perspective. This category represents the first ranked cause of injury for all ECH, rural, urban, males, and females. Once again, the rate and the hospital days rate for rural and urban residents have an inverse relationship. As in tables 15 and 17, this category carries implications for the data collection processes

Table 17

Hospitalizations Due to Injury From Falls

ICD-9 E888 (other and unspecified)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	1213	0.359	11.66	13.73	160.12	16652	103996
All Rural	700	0.35	12.73	12.4	157.83	8677	54978
All Urban	513	0.37	10.46	15.55	162.7	7975	49018
All Female	754	0.394	14.45	13.97	201.89	10537	52192
All Male	459	0.31	8.86	13.32	118.04	6115	51804

Hospitalizations from falls by age groups. The last outline of results from injury due to falling is presented in Table 18. Organized by age groups, it clearly illustrates the tendency toward higher rates and higher hospital days rates among the very young and the elderly. The decision to limit the youngest age group to a five-year span is based upon previous studies which have indicated that very young children experience different kinds and rates of injury than older children (Canadian Institute of Child Health, 1994; Injury Prevention Centre, 1996; Smith, Bowman, Luria, & Shields, 1997). The findings of this study support those conclusions.

Table 18

Hospitalizations Due to Injury From All Falls by Age Group

ICD-9 E880.0-E888

Age	Freq	Rate per 1000	Hospital Days Rate per 1000	Total Length of Stay	Popln
00-04 years	119	95.81	177.13	220	1242
05-14 years	270	16.49	31.84	521	16376
15-24 years	179	11.97	34.65	518	14951
25-34 years	125	9.43	38.34	508	13251
35-44 years	197	11.81	46.23	771	16677
45-54 years	195	16.01	99.4	1211	12183
55-64 years	247	28.7	57.87	498	8605
65-74 years	487	64.28	75.24	570	7576
75-84 years	904	163.59	2252.62	12448	5526
85 + years	659	358.35	6139.21	11290	1839

Table 19

Rate of Hospitalizations/1000 Due to Injury From All Falls by Age Group:1993-1998

ICD-9 E880-E888

ECodes	00-04 years	05-14 years	15-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
All Falls	95.81	16.49	11.97	9.43	11.81	16.01	28.70	64.28	163.59	358.35
E880.9 (stairs)	20.93	1.1	1.14	1.28	1.02	1.97	3.95	5.93	11.40	12.5
E881.0 (ladder)	-	-	-	-	1.5	1.15	2.91	2.38	1.99	-
E881.1 (scaffold)	-	-	-	-	-	-	-	-	-	-
E882 (building)	-	-	.67	-	.5	-	-	-	-	-
E884.0 (playgrd)	13.69	4.21	-	-	-	-	-	-	-	-
E884.2 (chair/bed)	11.27	-	-	-	-	-	-	2.77	10.31	22.8
E884.9 (two levels)	21.74	2.69	1.67	1.36	1.56	1.89	2.34	1.72	3.62	5.44
E885 (trip/slip)	8.05	2.87	2.61	2.49	3.6	5.25	9.06	22.04	60.08	125.61
E886.0 (sports)	-	1.16	1.40	-	-	-	-	-	-	-
E887 (fractures)	-	-	-	-	-	-	1.28	1.58	4.34	5.44
E888 (other)	11.27	3.18	2.27	2.49	2.34	3.94	7.44	26.79	69.85	184.88

Table 20

Hospital Days Rate/1000 Due to Injury From All Falls by Age Group: 1993-1998

ICD-9 E880-E888

ECodes	00-04 years	05-14 years	15-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
All Falls	177.13	31.84	34.65	38.34	46.23	99.40	57.87	75.24	2252.62	6139.21
E880.9 (stairs)	33.01	1.83	2.94	4.15	2.58	11.98	29.29	60.98	116.36	114.74
E881.0 (ladder)	-	-	-	-	5.28	9.36	13.71	12.28	14.11	-
E881.1 (scaffold)	-	-	-	-	-	-	-	-	-	-
E882 (building)	-	-	-	-	-	-	-	-	-	-
E884.0 (playgrnd)	16.10	8.37	-	-	-	-	-	-	-	-
E884.2 (chair/bed)	15.29	-	-	-	-	-	8.48	66.13	190.92	264.27
E884.9 (2 levels)	44.28	7.57	4.15	3.12	6.3	14.04	13.02	17.03	-	-
E885 (trip/slip)	-	9.16	4.68	20.07	9.71	18.96	37.54	236.67	748.28	2495.92
E886.0 (sports)	-	1.77	2.47	-	-	-	-	-	-	-
E887 (fractures)	-	-	-	-	-	-	6.74	20.33	77.63	-
E888 (other)	21.74	6.47	4.08	7.85	17.33	30.94	52.99	513.6	1026.42	3082.65

Motor Vehicle Collisions

Injury hospitalizations resulting from motor vehicle collisions. Health records technicians have one hundred ICD-9 E-codes available to collate hospital discharge information about injuries from motor vehicle collisions. Ten major categories are defined for motor vehicle collisions and each major category has ten sub-categories available to designate the position of the injured individual, specifically: driver, passenger, motorcyclist, passenger on motorcycle, occupant of streetcar, rider of animal, pedal cyclist, other person not yet specified, and unspecified unknown. Such a level of specificity was not conducive to calculation of rates of hospitalization from injury or calculation of hospital days rates for comparison purposes. Therefore, only the main categories were used with one exception: the collapse of two sub-categories about motorcycle drivers and their passengers.

Injuries from motor vehicle crashes are captured under Motor Vehicle Traffic Accidents (E810-E819.9) in the ICD-9 manual. Important distinctions are made between those incidents referred to as motor-vehicle non-traffic accidents, and motor vehicle traffic accidents. Traffic accidents are limited to incidents that occur on a public road and involve at least one motorized vehicle. The category excludes cataclysmic events and injuries inflicted from loading or unloading one vehicle from another.

Hospitalizations from all motor vehicle collisions. Table 21 contains the results of all hospitalizations related to motor vehicle traffic collisions over a five year period (1993-1998) according to the populations of interest. The figures presented in the second column of Table 21 represent the proportion of hospitalizations for *all* injuries from

motor vehicle collisions that occurred in either the urban/rural group or in the female/male group. The rate of injury for East Central Health region's rural residents is almost twice that of urban residents and the hospital days rate shows longer in-hospital stays. At the same time, the rate of hospitalization for males involved in traffic collisions and their hospital days rates are much higher than those for women.

Table 21

Hospitalizations From Motor Vehicle Collisions

All Motor Vehicle Related Hospitalizations by Residence and Gender

ICD-9 E810.0-E819.9

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	1026	1.0	9.87	6.99	68.99	7175	103996
All Rural	707	.69	12.86	6.17	79.38	4364	54978
All Urban	319	.31	6.51	8.81	57.35	2811	49018
All Female	397	.39	7.61	6.49	49.36	2576	52192
All Male	629	.61	12.14	7.31	88.78	4599	51804

The remaining tables in this section present results of the analysis according to specific E-codes and are categorized by their common elements. Specific to the external cause being described, the figures presented in the second column of the tables in this

section refer to the proportion of hospitalizations that occurred *within* each group.

Collisions with other vehicle. The tables created with information from ICD-9 E-codes 810, collision with train; and 811, re-entrant collision with another vehicle, contained cells that were too small to include here. Table 22 presents information about hospitalizations from motor vehicle collisions with another motor vehicle including parked, stopped, stalled, or abandoned vehicles (E812.0-.9). It also includes any motor vehicle collision not covered by other categories. Excluded from this coding are collisions with objects set in motion by another vehicle.

Injuries from two vehicles colliding ranks second of the eight collision-related categories presented. All ages are affected by these events but those aged 15-24 (4.55/1000; hospital days rate: 40.47) and aged 75-84 (4.7/1000; hospital days rate: 51.39) are most at risk. As seen in many of the tables with data from other causes of motor vehicle collisions, most of the injuries in crashes occur to those living in the rural part of the region and men are the greatest number affected. Again, when hospitalized, those living in rural areas remain longer.

Table 22

Hospitalizations From Motor Vehicle Collisions

ICD-9 E812.0-E812.9 (MVC with another vehicle)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	273	0.27	2.63	8.26	21.7	2256	103996
All Rural	171	0.24	3.11	8.73	27.14	1492	54978
All Urban	102	0.34	2.08	7.49	15.59	764	49018
All Female	130	0.33	2.49	8.54	21.27	1110	52192
All Male	143	0.23	2.76	8.01	22.12	1146	51804

Collisions with other non-motorized vehicles. Table 23 contains the results about hospitalizations from motor vehicle collisions with other non-motor transport vehicles (E813.0-.9). This means a crash with a bike, an animal-drawn cart, an animal carrying a person, or anything actually intended for transportation that is not a car or truck. The precision of the category resulted in some of the lower frequencies.

Table 23

Hospitalizations From Motor Vehicle Collisions

ICD-9 E813.0-E813.9 (MVC with non-motor vehicle)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	41	0.04	0.39	6.9	2.72	283	103996
All Rural	29	0.04	0.53	7.79	4.11	226	54978
All Urban	12	0.04	0.24	4.75	1.16	57	49018
All Female	14	0.04	0.27	6.14	1.65	86	52192
All Male	27	0.04	0.52	7.3	3.8	197	51804

Collisions with pedestrians. Injuries outlined in Table 24 are related to motor vehicle traffic accidents involving a collision with a pedestrian who may be dragged, hit, or run over by any kind of a motor vehicle on the road (E 814.0-.9). All age groups are affected by these injuries; females have a rate slightly higher than males. Contrary to most of the other tables, urban residents have a higher hospital days rate than rural residents for this type of incident. Although the hospitalization rate remains higher for rural residents, it is the smallest difference in the urban/rural rate among all the analyses for the motor vehicle categories. The difference in the hospital days rate and the hospitalization rate for rural and urban residents may indicate that rural residents are injured more often as pedestrians but urban residents require longer hospitals stays resulting from their injuries.

Table 24

Hospitalizations From Motor Vehicle Collisions

ICD-9 E814.0-E814.9 (MVC with pedestrian)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	52	0.05	0.5	8.92	4.46	464	103996
All Rural	30	0.04	0.55	6.83	3.73	205	54978
All Urban	22	0.07	0.45	11.77	5.28	259	49018
All Female	27	0.07	0.52	8.56	4.43	231	52192
All Male	25	0.04	0.48	9.32	4.5	233	51804

Collisions with objects. Table 25 represents hospitalization due to injuries from roadway collisions with objects on the highway such as an overpass, an animal, a safety island, a fallen tree, a guard rail, an object thrown on the road, or any fixed or movable object (E815.0-.9). Excluded from this category are objects off the highway that are hit during loss of control, objects thrown onto the vehicle itself, and vehicles that are parked at the side of the road. This is the category that would probably include cow, deer or other wild animal strikes.

The rank order of injuries from striking objects on the roadway is low but this is a category that is lead by females and rural residents in rate and hospital days rate. People aged 15-24 are involved in more of these crashes than other ages by quite a large margin

(rate:1.07; hospital days rate:3.81).

Table 25

Hospitalizations From Motor Vehicle Collisions

ICD-9 E815.0-E815.9 (MVC with objects)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	42	0.04	0.4	4.07	1.64	171	103996
All Rural	28	0.04	0.51	4	2.04	112	54978
All Urban	14	0.04	0.29	4.21	1.2	59	49018
All Female	24	0.06	0.46	3.67	1.69	88	52192
All Male	18	0.03	0.35	4.61	1.6	83	51804

Loss of control and collisions not involving another vehicle. Table 26 represents injuries caused by traffic incidents in which a vehicle goes out of control on the highway, fails to make a curve, the driver falls asleep, there is excessive speed, a tire blows out or bursts, or there is a mechanical failure and the vehicle collides with an object off of the road, the car rolls over, or the car stops abruptly off the roadway (E816.0-.9). This category does not include collision with another vehicle on the road.

The loss of control and rollover category is the highest ranked for all groups analyzed. Rates and hospital days rates for rural residents and males are much higher than for others. Although all age groups are affected, the 15-24 year olds experience

rates much almost twice those of the next closest groups, the 25-34 year olds and the 35-44 year olds. (12.64/1000, 6.87/1000, and 6.72/1000 respectively).

Table 26

Hospitalizations From Motor Vehicle Collisions

ICD-9 E816.0-E816.9 (MV loss of control off road)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	422	0.41	4.06	6.32	25.65	2667	103996
All Rural	319	0.45	5.8	5.39	31.25	1718	54978
All Urban	103	0.32	2.1	9.21	19.36	949	49018
All Female	135	0.34	2.59	3.99	10.33	539	52192
All Male	287	0.46	5.54	7.41	41.08	2128	51804

Unusual occurrences while operating a motor vehicle. Table 27 contains the analysis results for a complex category (E818.0-.9) that includes accidental poisoning from exhaust gas, explosion, falling or jumping or being pushed out, fire, being thrown against some part of, or injury from moving part of a vehicle-all of these possibilities must take place while the vehicle is in motion. The actual numbers are small but of note is that the male rates are triple those for females.

Table 27

Hospitalizations From Motor Vehicle Collisions

ICD-9 E818.0-E818.9 (MV explosion, fall out of, fire)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	49	0.05	0.47	6.9	3.25	338	103996
All Rural	33	0.05	0.6	6.15	3.69	203	54978
All Urban	16	0.05	0.33	8.44	2.75	135	49018
All Female	11	0.03	0.21	6.81	1.44	75	52192
All Male	38	0.06	0.73	6.92	5.08	263	51804

Unexplained motor vehicle collisions. Table 28 represents information from patient hospital records in which the cause of the incident is known to be a motor vehicle crash but the details are not clear or are not stated (E819.0-.9). Using such information to search for common causes of injury is not possible but this category provides one gauge of the impact of gaps on the patient records. This category ranks third overall in frequency for all groups. All of the age ranges have entries coded to this area.

Table 28

Hospitalizations From Motor Vehicle Collisions

ICD-9 E819.0-E819.9 (MVC unspecified or not stated)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	119	0.12	1.14	6.85	7.84	815	103996
All Rural	85	0.12	1.55	3.91	6.04	332	54978
All Urban	34	0.11	0.69	14.21	9.85	483	49018
All Female	46	0.12	0.88	7.78	6.86	358	52192
All Male	73	0.12	1.41	6.26	8.82	457	51804

Motorcycle collisions. Table 29 is a compilation of two sub-categories from all ten main categories. The frequencies for the categories defined as being related to motor vehicle crashes involving motorcycle drivers (.2) and passengers (.3) were added together to create a single category of its own (Eg. E810.**2**+E810.**3**+E811.**2**+E811.**3**...). Males dominated this category as did rural residents. Residents aged 15-24 were affected at the highest rate (1.87/1000) and those aged 25-34 were next (1.21/1000).

Table 29

Hospitalizations From Motor Vehicle Collisions

ICD-9 All .2+.3 (Motorcycle drivers and passengers)

Group	Freq.	Prop.	Rate per 1000	Avg. Length of Stay	Hospital Days Rate per 1000	Total Length of Stay	Popln.
All ECH	70	0.07	0.67	5.36	3.61	375	103996
All Rural	43	0.06	0.78	6.00	4.69	258	54978
All Urban	27	0.08	0.55	4.33	2.39	117	49018
All Female	12	0.03	0.23	4.42	1.02	53	52192
All Male	58	0.09	1.12	5.55	6.22	322	51804

Motor vehicle collisions by age group. The next tables represent a summary of all injury hospitalizations related to motor vehicle traffic collisions for all age groups of East Central Health region residents. Many of the individual categories already presented mirror the overall age-specific results of Tables 30, 31, and 32. The frequency, rate of hospitalization, hospital days rate, and total length of stay are all highest among the 15-24 year old age group. Those least affected by injuries from motor vehicle collisions are the 5-14 year olds. The very young and preschool group have a rate of hospitalization that is higher than the middle aged and elderly groups but the senior population once again have a higher hospital days rate than the young.

Table 30

Hospitalizations Due to Injury From All Motor Vehicle Collisions by Age Group: 1993-1998

ICD-9 E810.0-E819.9

Age	Freq.	Rate per 1000	Hospital Days Rate per 1000	Total Length of Stay	Popln.
00-04 years	16	12.88	62.8	78	1242
05-14 years	72	4.4	31.81	521	16376
15-24 years	360	24.08	155.44	2324	14951
25-34 years	177	13.35	90.56	1200	13251
35-44 years	112	6.72	39.82	664	16677
45-54 years	79	6.48	52.61	641	12183
55-64 years	55	6.39	57.87	498	8605
65-74 years	79	10.43	75.24	570	7576
75-84 years	57	10.31	95.55	528	5526
85 + years	19	10.33	79.39	146	1839

Table 31

Rate of Hospitalizations/1000 From Motor Vehicle Collisions by Age Group: 1993-1998

E810.0-.9 - E819.9

ECodes	00-04 years	05-14 years	15-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
All MVA	12.88	4.396	24.078	13.35	6.72	6.48	6.39	10.43	10.31	10.33
E810.0-.9 (train)	-	-	-	-	-	-	-	-	-	-
E811.0-.9 (re-entry)	-	-	-	-	-	-	-	-	-	-
E812.0-.9 (2 vehicles)	-	1.465	4.548	2.57	2.34	1.89	3.02	3.3	4.7	-
E813.0-.9 (non-motor)	-	-	-	-	-	-	-	-	-	-
E814.0-.9 (pedestrian)	-	-	-	-	-	-	-	-	-	-
E815.0-.9 (objects)	-	-	1.07	-	-	-	-	-	-	-
E816.0-.9 (loss control)	-	1.34	12.64	6.87	6.72	2.13	-	3.43	1.81	-
E817.0-.9 (boarding)	-	-	-	-	-	-	-	-	-	-
E818.0-.9 (unusual)	-	-	1.34	-	-	-	-	-	-	
E819.0-.9 (unspecified)	-	-	3.14	1.66	.78	-	-	1.45	-	-
all .2 + .3 (motorcycle)	-	-	1.87	1.21	-	-	-	-	-	-

Table 32

Hospital Days Rate/1000 From Motor Vehicle Collisions by Age Group: 1993-1998

E810.0-9 - 819.0-.9

ECodes	00-04 years	05-14 years	15-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
All MVA	62.80	31.81	155.44	90.56	39.82	52.61	57.87	75.24	95.55	79.39
E810.0-.9 (train)	-	-	-	-	-	-	-	-	-	-
E811.0-.9 (re-entry)	-	-	-	-	-	-	-	-	-	-
E812.0-.9 (2 vehicles)	-	14.59	40.47	25.05	11.93	-	30.8	19.8	51.39	-
E813.0-.9 (non-motor)	-	-	-	-	-	-	-	-	-	-
E814.0-.9 (pedestrian)	-	-	-	-	-	-	-	-	-	-
E815.0-.9 (objects)	-	-	3.81	-	-	-	-	-	-	-
E816.0-.9 (loss control)	-	5.86	63.07	50.94	17.63	28.15	-	22.31	-	-
E817.0-.9 (boarding)	-	-	-	-	-	-	-	-	-	-
E818.0-.9 (unusual)	-	-	8.43	-	-	-	-	-	-	-
E819.0-.9 (unspecified)	-	-	32.64	4.38	2.88	-	-	9.24	-	-
all .2 + .3 (motorcycle)	-	-	10.57	7.17	-	-	-	-	-	-

Chapter 5

Discussion

Already identified as the leading causes of injury-related hospitalization in Alberta's East Central Health Region, falls and motor vehicle collisions have been targeted by the local regional health authority for further research and program development. (East Central Regional Health Authority, 1997; Injury Prevention Centre, 1996). Separating the injury morbidity files for injury hospitalizations among East Central Health residents according to place of residence and by International Classification of Diseases, Injuries, and Causes of Death, 9th Revision, (1995) External cause codes provides deeper insights than previously available about hospitalizations of the region's residents resulting from falls and hospitalizations from motor vehicle collisions for population groups by age, gender, and place of residence. Study findings are consistent with much of the previously published research and contribute to a more detailed understanding of the influence that place of residence, and the concomitant differences that may exist, play in the occurrence of injuries in central Alberta. Further, the findings related to specific categories of external causes of the selected injuries serve to inform program planners about areas for further inquiry.

The discussion highlights the research findings before focusing first on injuries resulting from falls then on injuries from motor vehicle collisions. Implications of the findings for policy and program development are outlined according to cause of hospitalization and for East Central Health region. Finally, limitations and generalizability of the research are presented.

<u>Highlights of the research findings</u>

Injury hospitalization from falls by residents of East Central Health from 1993-1998 occurred at a slightly higher rate among rural residents (36.36/1000) than urban (28.21/1000) and the rate was higher among females (36.71/1000) than males (28.3/1000). The hospital days rate was much higher for East Central Health females (427.61 days/1000) than males (265.89 days/1000), but only slightly higher for urban residents (353.73 days/1000) than rural residents (341.1 days/1000). Falls on one level from tripping resulted in hospitalizations (10.2/1000) far more than any other category. Women in the region experienced the highest hospital days rate (150.83 days/1000) and this was due most often to trips on one level. East Central Health residents over 85 years of age were the group most often hospitalized from falls injuries (358.35/1000) and they experienced the highest hospital days rate (6139.21 days/1000).

Although hospitalization due to injury from motor vehicle collisions did not have frequencies even closely approximating those due to falls, motor vehicle collisions are still recognized as a major problem in East Central Health due to the nature and severity of the sequelae from vehicle crashes. Between 1993 and 1998, there were large discrepancies in the injury hospitalization rates and hospital days rates among identified groups in the region. Rural residents (12.86/1000) were hospitalized at a rate double that of urban residents (6.51/1000) and rural residents had a hospital days rate of 79.38 days/1000 compared to 57.35 days/1000 for urban residents. Males (12.14/1000) were hospitalized more often than females (7.61/1000) and males had a higher hospital days rate (88.78/1000) than females (49.36/1000). Loss of control with collision off of the

roadway had the highest injury hospitalization rate (4.06/1000) and a hospital days rate of 25.65 days/1000. Although injury from a two vehicle collision occurred less frequently, the hospital days rate was higher for all residents than the loss of control category. Those most affected by injuries from motor vehicle collisions requiring hospitalization were in the 15-24 year old age group (24.08/1000) and they had the highest hospital days rate at 155.64 days/1000.

Hospitalizations From Injuries Due To Falls

Working with the ICD-9 E-code categories for injury from falls proved to be much more of a challenge than initially anticipated despite the caution suggested by the published reports from the Injury Prevention Centre (1996), the publication by Ozonoff, Tan-Torres, and Barber (1993), and the experience of East Central Health colleagues. The ICD-9 manual does not consistently provide rationale for the selection and definition of the various external causes or for the organization of the causes. For some categories, the definitions are highly specific thereby yielding low frequencies. A subsequent category may be all inclusive resulting in nebulous conclusions for very high frequencies. Despite the limitations, some interesting and useful patterns emerged.

Overall hospitalizations from injuries due to falls. Overall, the hospitalization data related to falls is characterized by injury rates that are higher for rural ECH residents than for urban residents (Table 6). Upon closer scrutiny, there is an inverse relationship between the injury hospitalization rates for rural/urban residents and their concomitant average length of stay and hospital days rate. That is, rural residents have a higher rate of hospitalization from falls than do urban ECH residents but rural residents have a shorter

average hospital stay and hospital days rate than urban residents. Slips, trips, and stumbles (Table 14) exemplify this trend as they occur in higher rates for women and their hospital days rate is twice that of men. One explanation for the longer urban hospital stay may be the East Central Health Region demographics. Published research is clear about the over-representation of older adults in hospitalization statistics about falls (Raina & Torrance, 1996; Riley, 1992; Stokes & Lindsay, 1996). According to Tinetti and Williams (1997), once older adults enter hospitals after a fall, they often face challenges in returning to their former place of residence, particularly if living alone in the community. In East Central Health, as in other rural areas, people gravitate to larger urban centres as they move into retirement. This may mean that urban areas of ECH could have a greater concentration of elderly individuals who sustain longer hospitalization possibly related to limits in residential options, social support, severity of their injuries, or predisposing factors. Additionally, women predominate among the older age groups and often present with complicating risk factors such as osteoporosis. Population figures indicate that the overall number of women living in East Central Health region far outweighs the number of men, without exception, from age fifty-five and older (Alberta Health, 1998). The data for men and women on all ECH injuries from falling show higher figures for women in all parameters, particularly in the hospital days rate category. Additionally, among those age groups with a larger proportion of women, the hospital days rate is the highest.

The overall finding of greater frequency of injury from falling among rural residents but longer hospital stays among urban residents is not consistently repeated

throughout the analysis of specific E-code categories of injuries resulting from falls. Although it is seen in categories with higher frequencies in the elderly, those categories that are more typical of young people and which have smaller frequencies tend to reflect more consistent patterns of frequency, rate, and hospital days rate among the rural and urban, female and male residents.

Categories with unique characteristics. Some of the results may be considered in groups, particularly if grouping them does not create discrepancies in the final analysis. In Tables 8, 9, and 10, many of the injuries may be considered associated with involvement in construction, building, and occupations related to those activities. Despite the infrequent nature of reporting to these individual categories, they are still of interest because the frequencies are distributed across the adult age groups but are dominated by males and rural residents. As these three categories have common elements related to activity, it might assist a future analysis to collapse these three categories to determine if other patterns emerge that may be amenable to further inquiry. More specifically, the nature of these categories may lead to further investigation with rural men about the circumstances surrounding the injuries related to building and construction.

Falls among children. When distinctive features, such as a common activity or place of occurrence, can be identified through the E-codes for groups of injuries, there are important implications for policy development and program planning. Such is the case for injuries on playground equipment, typically a category of injuries limited to children. Because the population figures for all ECH residents were used to determine

the rates and the hospital days rates, the data presented about playground falls in Table 11 must be considered with caution. Clearly, these hospitalizations involved only a very specific part of the population: young children. This is clarified by the age related results in Table 20 where the data are contained in cells limited to children. However, the actual trends discovered using the population groups of rural, urban, male and female still provide useful information. The data presented here suggest that more rural children are hurt on playgrounds and that they stay in hospitals longer when they are injured in playground falls. Research and government reports show that many playground injuries occur as the result of old, faulty, or poorly maintained equipment and some injuries are related to surfacing and materials adjacent to the structures (Lesage, 1994; Winter, 1988). It would be important to know if the capacity of rural schools, service clubs, municipalities, villages, and hamlets to consult and implement appropriate maintenance and upgrades to public playgrounds is similar to that in the larger centres within the region. If it is not, that may be one explanation for the higher hospitalization rate of rural children but it does not explain the higher hospital days rate. It may be that rural children take more risks, or that they are more severely injured or that the transport time and emergency care en route to hospitals impacts their recovery. Alternatively, the distance that rural residents must travel to obtain medical and rehabilitative services could influence the length of time that injured children are kept in hospitals.

Young children are again affected more often than others in falls on stairs (Table 7) and falls from one level to another (Table 13). Both categories show that rural residents have a much higher hospital days rate than urban residents. Developmental

milestones such as learning to roll over, learning to walk and climb, balance, and cognition all play a significant role in injuries from falling among very young children (Garbarino, 1988; Stanwick, 1991). Most parents in Alberta are informed about developmental stages through routine visits to their local physician and through the anticipatory guidance of community health nurses during well child immunization services . The potential for injuries caused by motor vehicle collisions are often addressed during these visits, particularly the correct use of child passenger restraints in vehicles. However the extent of the injury problem related to children falling may not be as thoroughly covered and when it is, research points to limited success (Smith et al., 1997)

The higher representation of rural residents in the category of falls from one level to another among children may be related to the additional hazards faced by young children in the farming community. Research about children and farm related injury suggests that supervision and appropriate restriction around farming equipment for young children is essential to prevent serious injuries in that setting (Byard, Gilbert, Lipsett, & James, 1998; Injury Prevention Centre, 1995). However, arranging for supervision for young children in rural settings may be difficult due to the inconvenience of transportation and the costs associated with needing to work away from the farm at alternate employment (Health Canada, 1997). Equipment manufacturers are making significant progress in improving the design of new farm implements to increase their safety but it will be many years before the effect of improved engineering and design will be manifested as older equipment is replaced.

Falls from chair or bed. Injuries occurring as the result of falling from a chair or a bed (Table 12), (as seen in the categories for ladders and scaffolding) is another very precise category. For most self-reliant children and adults, falls of this type are rarely cause for hospitalization. However, for people less able to manoeuvre independently, such as the very young and the very old, position maintenance and stability is challenging. The results of the data analysis for falling from a chair or bed support the concept that, once again, elderly women in the larger centres could be more affected by certain kinds of fall related injuries than others.

Incomplete or non-specific patient charts. It is often difficult to clearly identify from a patient record the actual reason for the hospitalization. Tables 16 and 17 (unspecified falls and fractures) are examples of incidents for which the health records technicians either could not find circumstances in the record applicable to a certain E-code or the record was not clear enough to determine which category was appropriate. Unfortunately, over 30% of the injury cases are assigned to these two categories. This represents a significant gap in information available to ECH about the external causes of injuries requiring hospitalization from falling and limits the potential to create interventions to avoid or shorten hospitalization from those injuries. When the age groups are examined for the E888 category (falls with unspecified details), all ages have injuries coded to that category but the distribution is heavier among older adults. This may reflect that the hospital charts contain more details about the injuries to children and younger adults, and the injuries are coded more specifically into other categories. Alternatively, the frequency of falling in general is greater for the elderly and the rates

are higher among all of the falls categories for that group. This trend could simply carry over to the E888 category.

Development Of Strategies For Injuries Caused By Falls

With a joint approach in mind, much can be accomplished even within the health system to address injuries from falling. Over five years, people from the East Central Health region spent, in total, 36,092 days in Alberta hospitals because of injuries related to falling. Since the issue clearly touches many parts of the system, appropriate structures may be created within the organization that will work to prevent, mitigate, and rehabilitate injuries from falling.

Older adults. The results of the research related to injuries from falling point to the heavy use of the hospital system by injured older women, the elderly in general, and urban residents. Many of the larger centres in East Central Health have long term care facilities, assisted living complexes, lodge housing, and apartments built specifically for older adults. Joint policy development focussed on addressing falls could bring the issue to the fore and promote coordinated action from within agencies that are typically managed separately from each other. Sharing expertise and the scarce resources within small towns may extend the usual ability of these organizations to build ways to confront intractable problems.

The most frail of the elderly are at highest risk for injuries from falls. Studies of preventive measures for this group show only modest gains but multiple strategies may result in cumulative success (Close, Ellis, Hooper, Glucksman, Jackson, & Swift, 1999; Morse, 1997). Much controversy surrounds the use of restraint in acute and long term

care settings to prevent wandering and falling. The degrading nature of restraint devices has pushed managers to look closely at the risks and benefits of their use. Research is beginning to show that removing restraints does not lead to an increase in fall-related injury (Capezuti, Strumpf, Evans, Grisso, & Maislin, 1998). Least restraint policies, although ideal, force close scrutiny of staffing patterns and supervision of patients with the resultant negative impact on other essential services. Environmental assessment and alterations related to lighting, hand rails in bathing areas, non-slip flooring, and marked stairs are the least bothersome on a personal basis (Aminzadeh & Edwards, 1998; Morse, 1997). There is evidence that some medications contribute to the risk of falling for older people but large scale intervention has not been suggested beyond simple awareness campaigns targeted to continuing care organizations, physicians, and individuals by pharmacies and care providers (Cumming, 1998). Supported by the integrated, interdisciplinary approach advocated by Aminzadeh and Edwards (1998) and Close et al. (1999), specific injury control protocols for staff in acute and continuing care facilities that include detailed outlines for the care of individuals after injury from falling can not only speed recovery but can create linkages to community based programs for preventing another incident.

For the elderly, a first fall is a known risk factor for a second fall (Close, Ellis, Hooper, et al., 1999; Kiely, Kiel, Burrows, & Lipsitz, 1998). Balance and coordination activities in group settings can be feasible in larger towns either by recreation programs, occupational therapy, or physiotherapy. These have been recommended to promote the ability of people to recover from a near fall or slip but must be maintained over the long

term to be truly effective (Schoenfelder & Van Why, 1997; Campbell et al.,1997). Using research and evidence-based practice to guide the development of interventions, even the limitations imposed by questions of self efficacy and fear of falling may be overcome for those at serious risk of injury from falling by planned strategies to promote and enhance social support (Howland et al., 1998).

Moving outside of the health sector, new ideas and options for housing provide exciting opportunities to incorporate environmental supports for enhancing the abilities of people as they age. Some municipalities have already started working closely with older adults and health providers to create surroundings that better address the risks that are faced with aging. Adapted from Gallagher's STEPS Project, the GAIT program encourages citizens in the Camrose area of East Central Health to suggest environmental modifications, structural repairs, and community based solutions to the municipal engineering department to prevent falling and enhance access to all parts of the community. The local municipal council carefully considers the suggestions and purposefully incorporates them into their budget as they can (Gallagher & Scott, 1997).

Young children. Environmental adaptations are also relevant for the prevention of hospitalization from injury due to falling among the very young. Children experience falls from playground equipment as a natural course of learning and activity. However, the careful selection, installation, and maintenance of playground structures can interfere with the progression from minor scrapes to injuries requiring hospitalization (Lesage, 1994; Winter, 1988). Cooperation between those who have the background and experience in playground inspection and those responsible for creating play spaces could

make a difference for children. As a beginning, one school division in the East Central region has taken steps to ensure that a facility maintenance manager has current certification in playground safety audit techniques. Given that training and certification can be expensive, the potential exists for local service clubs and municipalities to take advantage of the knowledge and experience developed within the local school division and promote the techniques across the area. Although replacing old playground equipment is expensive, alternatives such as enhanced surfacing and appropriately spaced structures are more affordable in the short term. In East Central Health region, consultation and a few appropriately trained inspectors already exist but effort could be directed to aligning these resources with the rural areas of greatest need and enhancing access to expertise by those outside of the formal school systems.

Few strategies to prevent falls by children on stairs or steps or from a bed or chair have been shown to be successful. Banning the commercial sale of baby-walkers in Canada and the collection of old and discarded baby-walkers has had limited, though important success. Once a popular item, and a serious threat for falls among children, these products continue to circulate among parents both through their availability for purchase in the United States and by recycling from one family to another (Smith et al., 1997).

Farm-related injuries to children likely involve more external causes than those associated with falls and could be the subject of additional research within East Central Health. Supervision of young children is difficult in the farm setting but some families have started to create safe play spaces by using fences to enclose play areas within the

farm yard (Health Canada, 1997).

The results of this research on falls in East Central Health points to areas for possible development and further investigation. Injury and hospitalization among older women and those women in the larger centres may be likely target groups for further inquiry and potential program development. Additionally, young children and their parents could be a secondary focus for injury control related to injuries from falls. Research suggests that a blanket approach to the prevention and control of falls is unlikely to be effective, especially among the elderly (Allander, Gullberg, Johnell, Kanis, Ranstam & Elffors, 1998). Although a few scattered initiatives have already been started in the region, a thorough investigation of the identified target groups and the potential impact of region-wide policy development should be considered before strategies for East Central Health are developed.

<u>Hospitalizations Following Motor Vehicle Collisions</u>

<u>Overall hospitalizations from injuries due to motor vehicle collisions</u>. The overall findings in this study related to the age and gender of those most affected by traffic injury are well supported in other reports (Alberta Transportation and Utilities, 1997; Lefrancois & d'Amours, 1997; Ulmer, Williams, & Preusser, 1997). The youngest drivers and male drivers and passengers of East Central Health region are hospitalized far more often than anyone else in the region in most categories analyzed for motor vehicle collisions.

The impact of the rural and small town geography that defines the East Central Region has not previously been considered in creating possible interventions designed for

residents of the region. The results of this data analysis suggest that people living in the country, hamlets, villages, and smaller towns are hospitalized much more often than those residents of larger towns and small cities in the region. This may be related to a lower rate of seat-belt use and more frequent participation in high-risk driving behaviours among rural residents also shown in studies in other rural areas (Dunsire & Baldwin, 1999; Sahai, Pitblado, Bota, & Rowe, 1998; Thompson & Russell, 1994). The longer duration of their hospitalization may indicate more serious injury, limited injury control measures, delayed convalescence, or prolonged hospitalization perhaps from limited social support or appropriate level of care at home.

Although much of rural Alberta is accessible on paved highways, many secondary highways and roads are still gravel covered and present a potential hazard for even seasoned drivers. Individuals aged 15-24 are involved in vehicle related injuries at much higher rates in East Central Health than other age groups and are usually the least experienced drivers. Additionally, those who live in rural areas are more likely to travel on high speed roadways to get to even the most basic of activities such as grocery shopping, off-farm work, to school, and to recreational activities. This has the potential to place rural residents in a position of more frequent risk for not only injury but also for more serious injury than urban residents.

Hospitalizations by specific categories. Further questions are suggested by some of the more specific categories of analysis. The results of vehicle collisions involving pedestrians show a hospital days rate that is higher for urban residents than for rural residents, a finding contrary to most of the other results for the motor vehicle collision

group of injuries (Table 24). Given the potential for a higher population of female pedestrians in the larger centres, it might be postulated that older women could be more seriously injured during pedestrian/vehicle encounters and be urban dwellers. Closely examining the age specific data reveals that all age groups are affected by this kind of injury and the rates for men and women are closer than for most of the other categories. This may be indicative of a common element related to risk exposure to pedestrian injuries for females and males.

Loss of control (Table 26) is of interest among the external factors in motor vehicle collisions due to the frequency of injuries coded to this category in East Central Health. Once again, the hospitalization pattern of young, rural, and male drivers and passengers is repeated. Loss of control is a very broad category. Collisions of this type are known to be associated with any and all of the risk factors for vehicle accidents whether within the control of the driver or not. Weather conditions, swerving to avoid an animal on the road, or a tire blowout are beyond the immediate influence of the driver. However, some of the risk factors for this kind of incident are related to decisions made before and during driving a vehicle. Alberta Transportation and Utilities (1995; 1997) annually produces information collected from police statistics about vehicle collisions and report factors that may contribute to single vehicle collisions. Previous driving experience, consumption of alcohol, and speeding are risk behaviours included as factors within the control of drivers.

Table 27 (E818), the category for fires, explosions or falls while in motion, shows very large differences in male and female hospitalization rates. Considered a catch-all

for some of the more unusual occurrences while travelling in a vehicle, included here is the infamous "riding in the box of a pick-up truck". In consultation with local medical records clerks, they could not think of other circumstances not explicitly stated in the category that would be coded here.

In the overview of age related injuries presented in Table 30, it is interesting to note that those age 0-4 years rank third, behind the 25-34 year olds, in the rates of injury hospitalization from motor vehicle crashes. Although the rates are of note, the causes of injury to the very young are widely distributed across the E-code categories and do not present frequencies large enough for further analysis. It may be assumed that most of the injuries to young children are related to adult supervision in some respect, such as the appropriate use or non-use of child passenger restraints. Although adults over 64 years of age have noticeable injury rates, the rates for youth and young adults far exceed everyone else.

Development of strategies for injuries caused by motor vehicle collisions

Creating recommendations to tackle the problems presented by injury-related hospitalization resulting from motor vehicle collisions is complex. The locus of control and potential target for this issue is different from that related to injuries from falling. Internally, the health system is responsible for setting and applying standards to temper the effects of injuries after they occur. Determining the appropriate minimum response times for emergency services in rural areas is important as is the level of expertise of ambulance personnel and emergency department staff. Solutions are not simple for these issues in vast and isolated areas and few jurisdictions have the fiscal or human resources

to provide emergency services as well developed as those in larger centres.

Alternatives for areas like East Central region pivot on community involvement and advocacy. To fill in the gaps in the emergency medical service system, some local communities have built upon skills that exist within their own ranks. Small towns and hamlets often run their fire departments with well trained and drilled volunteers. A few areas have started their own quick response teams made up of the local fire department volunteers who receive supplemental training in emergency procedures and support techniques. They do not replace an ambulance service, but they do provide first response assistance in isolated areas until formal assistance can be engaged.

Advocacy and working toward common goals across sectors is essential to change the rate of injury hospitalization from vehicle crashes. Transportation departments could take advantage of research into road construction and engineering related to appropriate sight lines, pedestrian movement, sign placement, and lighting all which have the potential to improve safety on the roadway. For example, one Australian study found a significant reduction in casualty accident frequencies following improvements in road-shoulder paving on rural roads and calculated that the costs of paving were offset by the reduction in personal and property damage based on a usual traffic flow of about 360 vehicles per day (Ogden, 1997). Municipalities can consider speed limits and gravel road maintenance, both of which can impact “loss of control” traffic accidents. The Traffic Safety Survey conducted in East Central Regional Health Authority (1997) indicates that the population is supportive of the creation of regulations such as graduated licensing that can impact how young drivers gain experience on the roads

under less risk-laden circumstances. Numerous research studies have cited the potential positive impact that comprehensive graduated licensing can have on the frequency of collisions involving young drivers (Foss & Evenson, 1999; Phebo & Dellinger, 1998; Vernick, Li, Ogaitis, MacKenzie, Baker, & Gielen, 1999). Enforcement agencies require encouragement to apply regulations intended to protect the public safety. Recent research into the lower rate of seat belt use by rural Albertans suggests that much work needs to be done to change rural social norms that differ from those in large urban centres where most people adhere to seat belt laws (Sahai, et al. 1998; Thompson & Russell, 1994).

The health system is deeply affected by the consequences of injuries but it does not have control over the external factors that contribute to much of the problem. It is only by taking a comprehensive multisectoral approach that initiatives to deal with injury will succeed. The challenge remains in how to determine who is responsible for injury control when the solutions involve so many players. Under the realm of primary health service enhancement, community development principles such as empowerment and involving the target population applied to problem identification within a model of community based planning may be the key to opening the door of this intractable issue.

Policy and Program Development

Policy development within any organization depends upon the priorities that are determined by the Board of Directors with senior management and the application of those priorities in setting strategic directions for the agency. Recent planning documents from East Central Health (1999) express the intention to focus on *exploring expanded*

options for housing, integrating service delivery, and *fostering innovation* within the organization. Integration and innovation are ideals that can be useful when creating policy to address the issues related to injury. Housing options could particularly impact the hospitalization needs of the elderly not only by prevention of falls but also by reduction of hospital stays and provision of supportive environments to consider following injury. The results of this research project can contribute to the beginning of a targeted population-wide approach that could certainly embrace both integrated and innovative strategies for tackling old problems.

Hospitalizations resulting from falls and from vehicle crashes represent the most costly injury related expenditures for facilities in the East Central Region (East Central Health, 1999). As suggested by Johnson and Ratner (1995) in their work on health promoting behaviours, "...place might matter; geographic location may be an important determinant of health related behaviours" (p.103). The characteristics and distribution of people who are injured may be one focus for strategies to reduce some of the fiscal burden currently being carried, for addressing the RHA goal of improving health status, and for lessening the personal angst caused by injuries. Further clues for decision-making are provided by the categorization of the injuries according to the ICD-9 codes. Although some of the categories are non-descript, such as those for "other" or "not specified", others provide insight into reasons for hospitalization that may be amenable to further investigation and future intervention within and beyond the health system.

A comprehensive, integrated, multisectoral plan for injury control. Policy decisions demand choice among a multitude of necessities. It is essential to balance the

urgency of acute issues with insight into long term solutions and available resources. What is known about the way that many injuries occur leads to a better understanding that prevention, treatment, and rehabilitation programs cannot be created in isolation by only the health sector. Resource demands alone reduce the ability of one part of the system to address problems that cross agency and sectoral boundaries and venture into the realm of the broader social system.

It has been said that injury prevention and control is not the responsibility of any single organization, institution, or agency (Pless, 1989). However, the magnitude of the injury problem points to the responsibility of those organizations affected to work jointly to create solutions. Fostering a comprehensive plan to deal with the major causes of injury in East Central Health would further the movement toward integrated service delivery by engaging multiple sectors to handle the parts of the injury puzzle that pertain to their expertise and have impact on the other parts of the system. Such a comprehensive approach is the main thrust of a well functioning primary health system that has as its core values equity, community involvement, prevention as well as treatment, appropriate technology, and integration of the determinants of health into policy development (Stewart & Langille, 1995). Creative ideas like the international Safe Communities movement could take injury control beyond the boundaries of health and move it toward a multisectoral approach. Endorsed by the World Health Organization, Safe Communities invites organizations to band together with a committed public sector and citizens to move communities toward a comprehensive, integrated, community based approach to injury control that can serve to relieve the burden of the

few by distributing action across many (Injury Prevention Centre, 1998).

Limitations of the study

ICD 9 CM E-codes. During the analysis of injury hospitalization from both falling and motor vehicle collisions, the ICD-9 E-code categories presented challenges on several fronts. Overcoming problems with the way the data are collated across numerous diagnostic fields in the hospital morbidity files was not sufficient to deal with missing information and troublesome code definitions. The categories that contain definitions related to *information not stated* or *not specified* have large frequencies that give pause to what rich information may be missing from the patient in-hospital record and are, therefore, not included in the more specific categories. Drawing conclusions becomes difficult when some code definitions are very specific with limited frequencies while others are so broad that they contain information that relates to numerous risk factors.

Rates by residence and gender. It would have been worthwhile to calculate more specific injury hospitalization rates according to place of residence by gender and age. The final data file is easily organized by urban, rural, and gender for basic frequencies but the population parameters linked to postal codes for rural and urban residents are for the entire population and are not organized by age group or gender. Therefore, calculation of the denominator required for the whole population split according to rural and urban and age groups was not possible. In other words, the age of those injured was on one data base but the age of those injured plus those not injured was not available within the postal code information. An attempt was made to estimate the number of males and females by urban and rural residence but the estimate was based on the gender

concentration in the entire region and after looking at some of the results, it was determined that the overall estimate may be in error if, indeed, more women actually do reside in the larger centres. Thus, the attempt was abandoned.

Generalizability. Finally, the results of this research are generalizable only to the East Central Regional Health Authority geographic area. The population demographics of the region are *not* typical of other Alberta rural regions. East Central Health has few Aboriginal communities, a population considered at higher risk for injuries of all kinds (Health Canada, 1997; Yacoub, 1999). ECH region has one of the highest concentrations of older adults in the province and one of the lowest birth rates, a consideration for the differences in injury rates related to age groups. Even the larger centres in East Central are small in comparison to many regions except, perhaps, in the north. Major urban and rural sources of employment are shared with other regions: self employment through farming or public service through the education and health sectors. The unemployment rates for ECH are the lowest in the province and fluctuate only with oil industry activity and farm commodity prices. In terms of rural and urban differences, it is still unclear which factors may contribute to overall differences in injury hospitalization rates and the different influences that may be experienced by other regions. Further, policies related to hospital emergency room triage, transfer to larger tertiary and quaternary care centres, limitations or allowances for length of hospital stay, and available community resources all differ from one region to the next within Alberta.

Chapter 6

Conclusion

Injuries caused by falls and motor vehicle collisions are important to morbidity in East Central Health Region. Addressing the underlying causes of those injuries and hospitalizations requires a systematic approach including multiple disciplines working in a complementary way to create strategies that cross sectoral boundaries. Andersson and Menckel (1995) propose specific elements related to time (prepathogenic and pathogenic), levels of investigation (individual, community or organization, and society), phases of development (community development or technology development), and interaction components (man, machine, environment) that are useful in conceptualizing injury control. Taking all of the elements into consideration creates a basis for sound planning for injury control.

Simply investigating two classifications within the many external causes of hospitalization from injuries in East Central Health Region does not address all of Andersson and Menckel's elements of the study of injury and is insufficient to provide a grounding for broad-based policy and program development in injury control. However, the purpose of the research project was to contribute to the beginning of a rational plan to address the problem of unintentional injuries among the people of the region, and this study exemplifies a small step in that journey. The findings of this research support, in part, research done with other populations but they also suggest some potential differences between urban and rural residents of ECH, possibly based on geography, demographics, and cultural norms that might be considered important for East Central

Health region to consider.

Major Findings

The components of Andersson and Menckel's model were identified as part of the framework for this study. Clearly, the findings do not incorporate all of the elements of the model. However, coupled with published research, the findings lead to recommendations for East Central Health and a conclusion that wholly embraces the four essential factors.

Best exemplified in the research findings are the time-related periods referred to by Andersson and Menckel (1995) as pre-pathogenic and pathogenic. The findings are descriptive of pathology in terms of hospitalization following the injury event. However, the overall purpose of reporting pathology in an organized way in this research is to consider the external factors that influenced the event with the hope of creating interventions focussed on the prepathogenic period.

Individual, community or organization, and society are the three levels of intervention in the injury model. First, in this research individuals are reflected by the morbidity data in the case by case reporting system. Second, community and organization are defined geographically by the East Central boundaries and within those boundaries by rural and urban areas. Finally, societal considerations for intervention prepathologically are discussed later in the policy suggestions for East Central Health.

Neither the injury model's community development principles nor technological development were used in producing the research findings. Although the study was intended to explore pathology with a goal to creating recommendations for strategy

development, the findings are limited to descriptors only. Further work will be required to extrapolate these findings into strategic development.

Andersson and Menckel's final category is the epidemiological triad of man, machine, and environment. Although the findings do not delineate among the three in the categories related to injuries from falls, the descriptors accurately reflect the close relationship that exists therein when studying the pathology of injury from motor vehicle collisions. In particular, man is exemplified by individuals injured, and machine and environment are seen through descriptions of the external causes of the injuries.

Injury hospitalization from falls in East Central Health from 1993-1998 occurred at a slightly higher rate among rural residents than urban and the rate was higher among females than males. The hospital days rate was much higher for East Central Health females than males, but only slightly higher for urban residents than rural residents. Falls on one level from tripping resulted in hospitalizations far more than any other category. Women in the region experienced the highest hospital days rate and this was due most often to trips on one level. Those ECH residents over 85 years of age was the group most often hospitalized from falls injuries and they experienced the highest hospital days rate. Unfortunately, a large proportion of the injuries from falls were not coded by health records clerks into specific categories but were entered into categories such as "not stated" or "unspecified". Noted as a limitation to the study, this problem has also been encountered by other researchers who work with hospital injury morbidity data to try to clarify the nature of the injury problem (Injury Prevention Centre, 1996; Raina & Torrance, 1996).

Large discrepancies are noted in the injury hospitalization rates and hospital days rates for injuries from motor vehicle collisions between 1993 and 1998 among identified groups in the region. Rural residents were hospitalized at a rate double that of urban residents and rural residents had a higher hospital days rate. Males were hospitalized more often than females and males had a higher hospital days rate than females. Loss of control with collision off of the roadway had the highest injury hospitalization rate among the ICD-9 E-code categories for motor vehicle collisions. Although injury from a two vehicle collision occurred less frequently, the hospital days rate was higher for all residents than the loss of control category. Those most affected by injuries from motor vehicle collisions requiring hospitalization were in the 15-24 year old age group and they also had the highest hospital days rate. The study and final results suggest areas for further research and have implications for planning in East Central Health.

Implications for Nursing

The McGill model of nursing suggests a systems approach for nurses using varying levels of expertise within a health promotion context (Allen, 1981; Epp, 1986; Gottleib & Rowat, 1987; Hancock, 1994). Nurses are involved in health promotion related to injury in all facets of health care and, in some cases, beyond the boundaries of health. This research has implications for practice in administration, research, acute care, emergency care, community health, long term care, and rehabilitation in East Central Health.

Health promoting public policy can be influenced by an understanding of the age groups most affected by certain kinds of injury. Nurses at the administrative level can

utilize the findings about falls among the elderly to adjust policies about protocols for assessment of the risk for falls in residential care or in home settings. The rate of injuries from motor vehicle collisions in rural areas may prompt nursing care coordinators to carefully assess the level of expertise required by nurses assigned to emergency rooms in those settings.

Home care nurses and nurses in rehabilitation settings may consider searching the literature and consulting with experts to develop a joint assessment protocol for the elderly in East Central Health's larger centres. The assessment could be translated into action to create supportive environments within a family context.

Community action could be enhanced for rural areas by public health nurses through dissemination and discussion of the results of this research in smaller communities. Exploring the higher rate of injury with young rural residents may lead to creating partnerships within the school or youth group setting in which the development of personal skills to avoid injury may be promoted.

Injury control requires the focussed attention of multiple stakeholders to the issues of prevention, treatment, and rehabilitation of injuries. Nurse leaders at all levels and within all sectors of health could use the findings of this study related to the age groups and usual residence of those injured to focus their efforts to determine research based strategies for prevention, best practice protocols for treatment, and supportive measures most appropriate for the age and residence of their patients. Nurses in smaller communities and rural settings are often required to have generalized, global knowledge. These findings may help to narrow the content areas for the development of high level

expertise in some settings (Epp, 1986; Hancock, 1994).

Recommendations for Further Research

It is important that further research address the limitations suggested by this study as well as questions that were not answered in this work. Data collection practices related to ICD-9 CM E-codes are clearly an area in need of supportive research. As previously noted, almost one-third of the cases of hospitalization from falls and motor vehicle collisions were identified as unspecified or unknown. Clearly, the morbidity data files have good potential to support health research but could be improved by understanding the problems encountered at particular phases in the interpretation and entry of the data. Health records clerks, hospital nurses, physicians, and emergency personnel all have a role in either creating the elements for interpretation or translating the recording into coded data. Representatives from each area could be involved in a research project to identify the flow of information, how health records clerks search for clues to support their coding decisions, and the issues related to appropriate detail in recording on patient charts.

It is not sufficient to understand only the external causes of injuries in creating interventions to prevent or treat them. For example, this research identified that young children in East Central Health are injured during falls from stairs and steps. These results could be enhanced by understanding the characteristics of those injurious situations that may be amenable to change. The Canadian Hospitals Injury Research and Reporting System is looking more closely at the characteristics surrounding injuries but, again, is focussed in large urban centres and the north. It is not yet clear that the nature

of the circumstances surrounding injuries to children in larger centres is the same for children in smaller and rural areas.

The research according to rural and urban residence in East Central Health suggests that some residents have longer hospital stays for specific injuries, for example rural residents from motor vehicle collisions and urban residents related to falls. Although statistics are available on a provincial basis about some of the risk factors that contribute to these injuries, more detailed summaries of those statistics could be developed according to the East Central Health geographic area, such as those from Alberta Infrastructure (formerly Alberta Transportation and Utilities).

Originally, the intent of this research was to investigate the influence of geographic residence on injury hospitalization and mortality by separating the morbidity data and the mortality data provincially according to rural or urban residence and further, for East Central Health specifically. The procedures developed to separate the data files according to postal code were too cumbersome to be applied in a timely manner to the entire provincial data set. However, important differences in hospitalization and in hospital days rates were discovered in this project and it would be valuable to attempt a revised version of the study beyond the boundaries of East Central Health.

Hypotheses. Valanis (1992) is clear that phase one of the process to address a health concern is based upon gathering information about risk factors related to the issue and suggesting hypotheses for further testing through analytic epidemiological research. This study investigated risk factors related to place of residence, gender, and age as they were associated with specific external causes of two types of injuries: falls and motor

vehicle collisions. The results of the data analysis related to hospitalization from injuries in East Central Health coupled with research studies such as those by Close et al. (1999), Foss and Evenson (1999), Gallager and Scott (1997), and the recently released Alberta Rural Seat Belt Survey report (2000), suggest at least two possible hypotheses that could be tested in future research:

1) Policy development and program implementation targeted toward urban women over 65 years of age in East Central Health will result in a 10 % reduction in the rate of hospitalization for injuries due to falling over a 5 year period.

2) Policy development and program implementation targeted toward young rural male drivers and passengers aged 15-24 years will result in a 10% decrease in hospitalization from injuries resulting from motor vehicle collisions over a 5 year period.

Policy Development

A comprehensive, intersectoral, multidisciplinary approach to the development of revised policies and programs related to injury control is highly recommended if these hypotheses are to be considered for testing by ECH. "Policies are broad statements of goals that may assume two forms: general goals and operational goals. Programs are the measures taken to achieve those goals, to implement those policies" (Brooks, 1993, p.111). Overarching policy statements and operational goals related to injury prevention already exist within East Central Health's (1999) business and operational plans. However, if interventions are to be developed that might serve to address the injury issue more completely, then further and more specific policy development will be necessary.

The East Central Region would benefit from policies that expand injury strategies

beyond the boundaries of prevention and community health to incorporate Andersson and Menckel's time related factors. The time factors lead to interventions in prevention, during the injury event, after the event, and in the mitigation of long term effects of injuries. This strategy allows for close scrutiny of the relationships between man, machine, and the environment as they influence injuries in rural and urban settings. Andersson and Menckel's (1995) synthesized theory of injury interventions implies that moving beyond prevention and into control of injuries requires both a top-down approach and grassroots development. Following their principles also means involving multiple stakeholders in strategic development: individuals, organizations, and communities. A dual-direction approach to the development of injury control requires patience but with careful thought, appropriate qualitative and quantitative data analysis, sufficient resources, and means to disseminate innovation to the field level, it may be done.

To successfully negotiate the myriad of possibilities, comprehensive policy development and program selection needs to stand the test of scrutiny. Stakeholders with a vested interest and representing a variety of perspectives could be recruited to critically participate in the developmental process. Beyond the board and senior management level, this includes those potentially affected by the change: field staff, managers, potential participants, and external partners such as town councils, lodge housing managers, and enforcement agencies. The level of impact, sustainability, research and evaluative base, costs, staff resources, expertise, and acceptability by the target population are challenges that require careful deliberation when setting the course for confronting injury problems. East Central Health has developed the corporate culture,

set the strategic directions, and has started to create the supportive structures necessary to face such challenges.

East Cental Health may have experienced as much success in controlling the former intractible problems with communicable diseases as the many other regions, provinces, states, and countries of the industrialized world described by the World Health Organization. At the same time, the region struggles with injuries similar to those of other areas, rural and urban. Progress to limit the impact of communicable diseases took patience, time, and cumulative research. The same attributes will be necessary to control injuries both locally and world wide. The limited scope of this research and its focus on one Alberta health region may nonetheless prove to be one of countless small steps in the journey to learn more about the control of injuries in the broadest sense.

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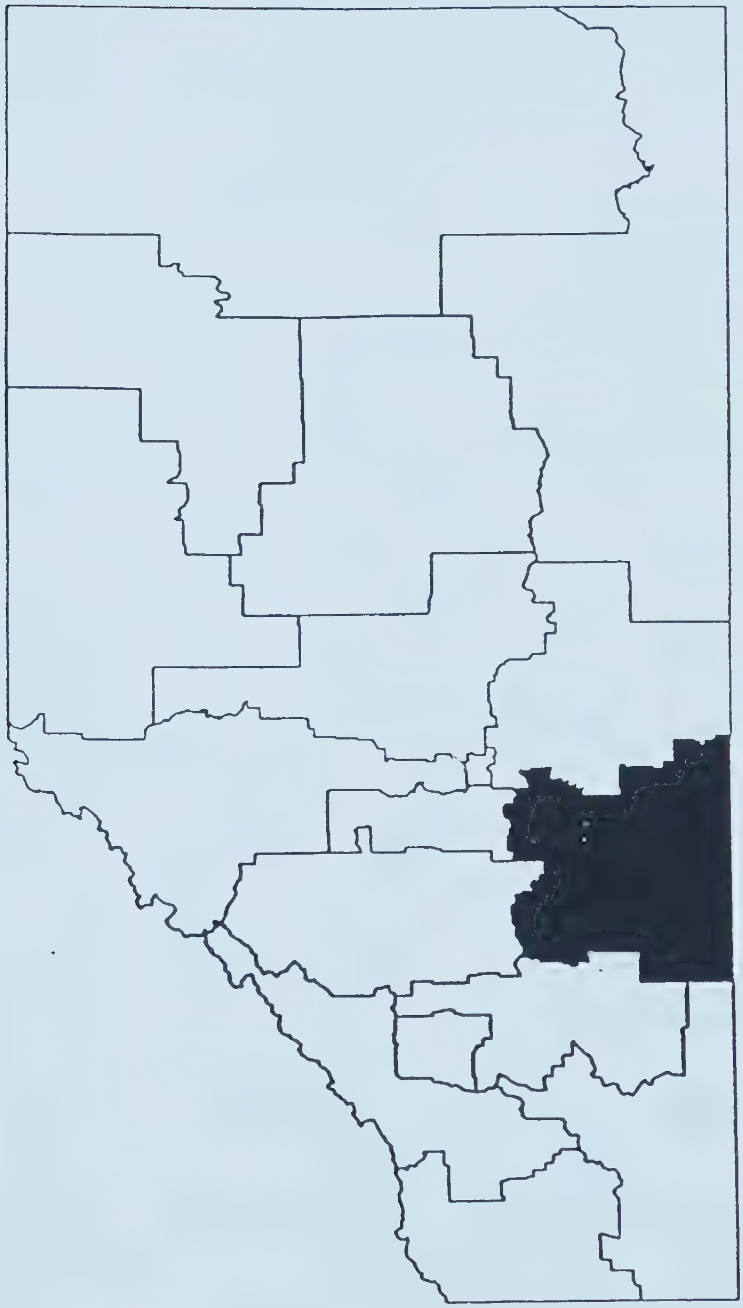
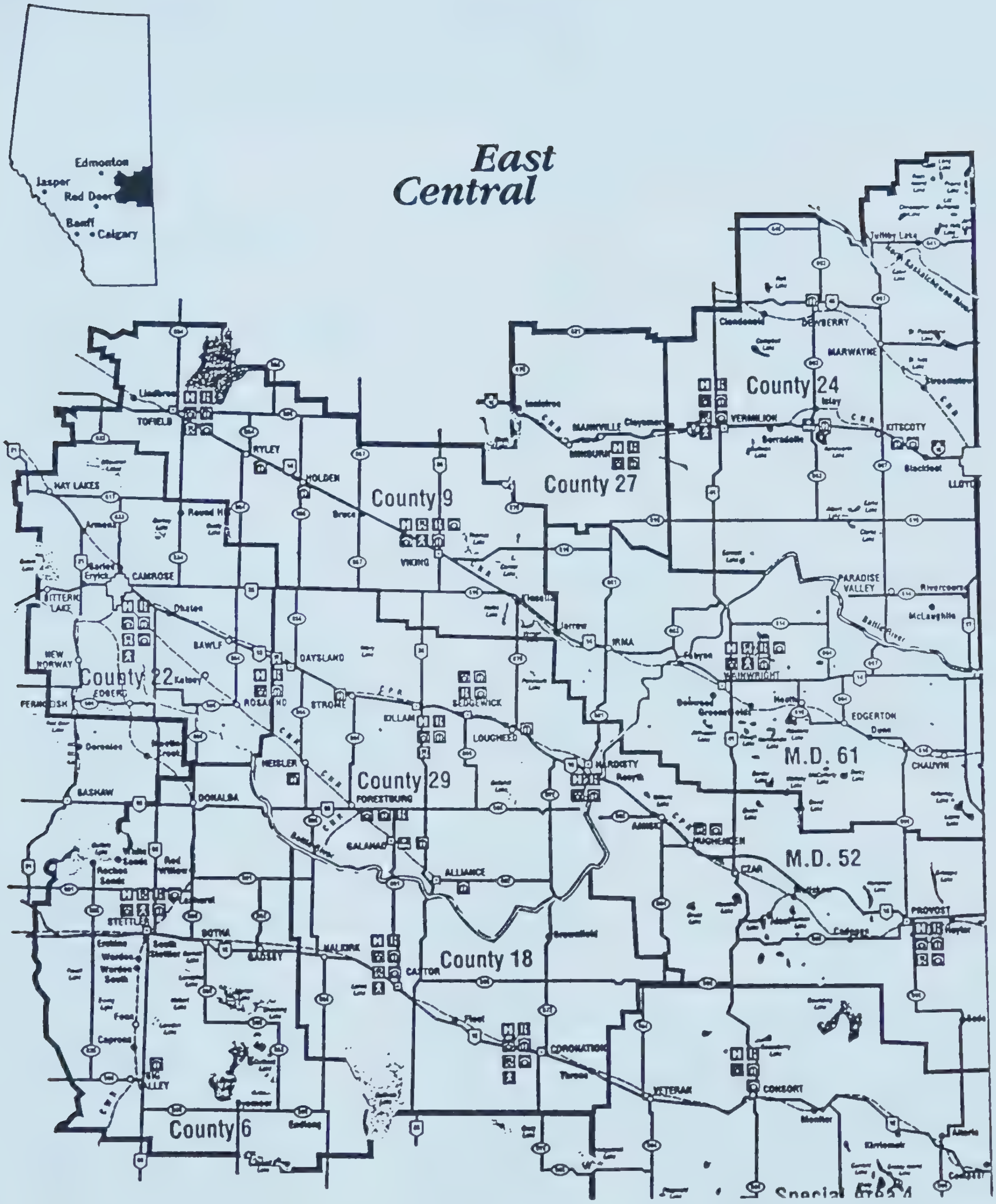
Region 7



EAST CENTRAL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STETTLER
BOTHA
GADSBY
HALKIRK
BIG VALLEY
IRMA
BITTERN LAKE
HAY LAKES
FERINTOSH
EDBERG
MINBURN

east central health

4703 – 53 Street, Camrose, Alberta T4V 1Y8
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July 9, 1999

Our Reference: 14-29-03

Jennifer Currie
Stettler Community Health Services
Box 550
STETTLER, Alberta T0C 2L0

Dear Jennifer,

In response to your request for data relating to falls and motor vehicle collisions, I am providing you with individual anonymous provincial hospital separations morbidity data relating to these types of injuries for patients with an assigned resident RHA of 07. Motor vehicle collisions and falls are identified according to the International Classification of Diseases, 9th Revision, Clinical Modification, External Causes codes with codes E880-E888 assigned to falls and codes E810-E819 assigned to motor vehicle accidents. The data provided is data for fiscal years 1993/94 to 1997/98 inclusive and has been provided in an Access database. The number of records in the database total 4,457. The data fields are in the following format:

FIELD	DESCRIPTION	SIZE
admit_dt	Admission date	Date/Time
disch_dt	Discharge date	Date/Time
los	Length of stay	Number (long integer)
age_code	Identifies years, months or days	Text 1
age_unit	Age of patient (to be used in conjunction with age code).	Text 3
rsdt_sex	Resident gender	Text 1
rec_no	Record number	Text 6
rsdt_mun	Residence Code	Text 8
rsdt_md	Municipal district of the patient	Text 2
MRDx	Most Responsible Diagnosis	Text 2
Dx_1 to Dx_15	Secondary Diagnoses (to a maximum of 15 diagnoses)	Text 5

FIELD	DESCRIPTION	SIZE
rsdt_pc	Resident postal code	Text 6
RHA_res	Recipient RHA from Residence Code	Text 2
RHA_pt	Recipient RHA at Mar. 31 (according to the AHCIP registry)	Text 2
Allseps	Identifies each record as 1. To be used as a counter	Number (long integer)

I will require a signed Statement of Intent for this data. **Also, please be advised that this information was obtained from morbidity files provided by Alberta Health. This information may be used only for health related research to support policy development and program planning. The data may not be published or released to the public without prior review and approval by the Minster of Health (through Region 7 administration).**

If you require any clarification of the data provided, please feel free to contact me at (403) 608-8847.

Sincerely,

Laurie Walz

Laurie Walz, CCHRA©
Health Information Analyst

Encl

east central health

EAST CENTRAL REGIONAL HEALTH AUTHORITY 7

STATEMENT OF INTENT

HOSPITAL MORBIDITY DATA
(FALLS AND MVC's 1993/94 to 1997/98)

I hereby agree that, prior to receiving data from the hospital morbidity files, provided either by Alberta Health or by the East Central Regional Health Authority, I agree to the following conditions for data release:

1. The datafiles will be used solely by me, under authority of the East Central Regional Health Authority 7, for operational, planning and/or research purposes;

2 The datafiles will be kept in a physically secure location and access to the datafiles must be restricted through the use of passwords and other database security measures;

3. No linking of records to any other databases will be attempted without prior authorization from the Regional Data Coordinator;

4. The datafiles will not be transferred or copied to anyone without prior authorization from the Regional Data Coordinator;

5. Any materials which describe results of research of the datafiles must be written and presented in such a way that no individual can be identified as to whom the information relates or in any other way on account of or related to the information.

6. The data including all findings, interpretations and results concluded from the information obtained under this Statement of Intent may not be published or released to the public without prior review and approval by the Regional Data Coordinator, who in turn must receive approval by the Minister of Health.

7. I may be legally responsible for any claims, demands, actions or costs whatsoever that may arise directly or indirectly due to improper disclosure of information from these datafiles;

8. Upon completion of my project, the original datafiles and any copies made of them will be returned to the Regional Data Coordinator and any files copied to a network or workstation harddrive will be deleted.

I understand the above terms and conditions and agree to adhere to them.

Jennifer R Currie
Signature

Jennifer R. Currie
Printed Name

July 16/99
Date

east central health

4703 – 53 Street, Camrose, Alberta T4V 1Y8
Tel (780) 608-8820 Fax (780) 608-8838 www.ecrha7.ab.ca

November 24, 1999

Our Reference: 11-01-01

Jennifer Currie
Box 189
Big Valley, AB.
T0J 0G0

Dear Mrs. Currie:

RE: RESEARCH PROJECT

This letter is to confirm our support for the research that you have completed about injuries among residents of East Central Health. You have a signed data agreement on file with us that permits access to information about hospitalization through our morbidity files. It includes a provision that precludes publication of your results until permission is received from the Minister of Health. We will be pleased to approach the Minister of Health to advocate for permission to publicly release the results of your study. It is understood that you will produce a completed thesis for the purposes of fulfilling the requirements of your Master of Nursing program at the University of Alberta.

We appreciate and applaud your efforts in this project and wish you success in obtaining your Masters Degree in Nursing.

Sincerely,

Steve Petz
President & CEO

SP/rkb

Appendix D

Creation of Data Files and Data Analysis

This appendix is a more detailed outline of the process that was involved as the morbidity and population data files were created, linked, and the variables manipulated.

Morbidity Data Base: East Central Health

The data coordinator for East Central Health accessed Alberta Health's province-wide hospital morbidity data base for all hospital separations from the years 1993-94, 1994-95, 1995-96, 1996-97, and 1997-98. The data coordinator then extracted data from the hospital morbidity data base according to the variable list in Table 1, for the time frame indicated, and according to the Regional Health Authority number for East Central Health (#7) indicated as the usual place of residence of the hospitalized patient. Further, the data were limited to the ICD-9 CM E-codes that specifically pertain to hospitalization from injuries due to falls and motor vehicle collisions (ICD-9 CM E-codes E880-E888 and E810-E819) in any of the fifteen diagnostic fields. A list of all postal codes used by Alberta Health to determine place of usual residence and a list of residence codes for all ECH communities according to the postal codes routinely used by residents of those communities were provided to the researcher by Alberta Health.

The researcher closely examined the morbidity data file to ensure that only residents of East Central Health Region were included in the file. Postal codes and residence codes were used to confirm the selection of Region 7 (ECH) by Alberta Health as the place of residence for the patient. Residence codes are designed to identify the closest town or village to the actual place of residence of the patient. Where no postal

code was entered, or the postal code did not fit within the usual ECH code list, the residence code was used to determine whether the case should remain in the data file.

Postal codes were a key link in the research procedures so cases that were missing postal codes but had been assigned to ECH by Alberta Health were given a surrogate postal code selected from the inactive postal codes for the East Central Health area. One surrogate postal code was used for rural residence as determined by the residence code and another surrogate code was used for urban residence. One hundred and thirty-seven cases required surrogate postal codes. The procedure to determine rural or urban designation is described with the population and postal codes data base.

Age was another variable that required confirmation. Infants were included in the field according to their age in months and all other patients were included according to age in years. A different field contained a code to differentiate between months and years. To avoid requiring the second field in the data analysis, the age of all of the infants was altered to 00 to prevent including them with older age groups. This procedure involved 47 cases.

During the data analysis, the morbidity data base was linked to a second data base (the populations and postal codes data base) according to the patient's postal code. The postal codes were assigned a designation of rural or urban in the second data base using procedures described below. A new field was created in the morbidity data base to accommodate the rural or urban designation when the data bases were linked and the data frequencies summarized.

Populations and Postal Codes Data Base: Alberta Health

Alberta Health provided consultation and expertise in the creation of a data file that contained the variables listed in Table 5. Most salient of the variables were those for the Census Canada population figures for each East Central Health community, the Alberta Health Registered Population for all ECH communities, and the postal codes according to each community within East Central Health Region. All of the Alberta Health population figures were aligned to the postal codes for each community.

The researcher created an additional field in the populations and postal codes file to carry an assignment of rural or urban to each of the 1747 postal codes considered as belonging to East Central Health. Communities of less than 2,500 people, according to Census Canada, were labeled rural and those with more than 2,500 people were labeled urban. In essence, this meant that only 4 communities in ECH would be considered urban and no communities were close to that cut-off point in population. For example, the population of the smallest town designated as urban is over 3,000 and the next closest community is just under 2,000 people. Accordingly, all of the postal codes were tagged “r” or “u” in the new field.

One field in the populations and postal codes file was reserved to compare the population according to Census Canada figures with the population according to the Alberta Health Registered Population. This field provided a means to compare the approximate number of people that actually lived within the population centre (Census Canada figures) with the number that lived outside the population centre but claimed that area (according to postal code) as their residence for the purpose of registration with

Alberta Health. Comparison of Census Canada and Alberta Health registered populations' postal code-based figures supported the decision to use the postal codes of a community to determine rural or urban status. For the purpose of the research, an assumption was made that people who live outside the confines of a population centre but who were registered with Alberta Health as belonging to that community would, in many cases, actually reside in the rural area surrounding the community. To confirm the previously described decisions based on a demarcation of 2,500 people, the researcher went back to the field containing the comparison of populations and found that most of the larger communities designated as rural actually did have a much larger proportion of their populations registered with Alberta Health than Census Canada populations.

The postal code and population data were summed according to rural population, urban population, total population, and according to total number of postal codes assigned to East Central Health by Alberta Health in order to ensure that none of the postal codes or communities had been inadvertently missed. The figures corresponded to the expected population registered with Alberta Health (103,996) and the number of postal codes expected for ECH (1747).

Unfortunately, the populations and postal codes data base did not contain a field for population according to age. Therefore, age specific rates could not be calculated separately for rural and urban communities.

<u>Creating Frequencies and Rates</u>

Determining the number of hospitalizations for the injuries of interest and separating the data according to rural or urban residence required linking the morbidity

data base with the populations and postal codes data base. The researcher used Access software and linked the data bases according to their similar fields for postal codes and for rural/urban residence. The linking procedure was used for all data runs and was supplemented by further commands according to specific ICD-9 CM E-code descriptors for the external cause of the injuries, according to age and by sex. For each question, the data were run through 15 times: once for each diagnostic field in the morbidity data base that might contain an E-code for the injury of interest.

It was not possible in Access to create electronic sums of the 15 individual data runs for each question. Consequently, Excel spreadsheets were developed and the results of each run were entered onto spreadsheets according to the E-code category and the question of interest. For example, when examining the data for injuries due to falls according to residence and sex, spreadsheets were used for falls by E-code, for rural males, rural females, urban males, and urban females. From the 30 or more pages produced during the individual data run, results were entered onto spreadsheets according to the category of interest and the E-code attached. Sums were then possible for each E-code category of external cause of the injury. Although it is theoretically possible for one individual to have more that one E-code for the same hospitalization, it is not likely common for there to be two external causes specifically related to falls or to motor vehicle collisions for one individual for a single hospitalization.

As described in Chapter 3, all frequency totals were closely examined and compared to the overall ECH totals and separate totals for rural and urban populations. When errors were located, the researcher went back to the original Access data run,

compared it to the spreadsheets, corrected the errors, and recalculated frequencies until it was clear that all transferred data was accurate. Finally, the sums were collapsed appropriately and tables were developed as in Chapter 4. Similar procedures were used for length of stay, average hospital days, and each of the remaining calculations.